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MONTHLY WEATHER REVIEW

DECEMBER 1941

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MONTHLY WEATHER REVIEW

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RAINFALLS OF 10 INCHES, OR MORE, DURING 24 HOURS, IN THE UNITED STATES

By STEPHEN S. VISHER

[Professor of Geography, Indiana University, Bloomington, Ind., May 1941]

The purpose of this paper is to make available a compilation of 293 official records of excessive rainfalls that the writer has assembled. It is believed that the data here collected will be of value for many purposes; but in using them, it must be kept in mind that they do not constitute a complete record of all excessive rains that have occurred in the United States. The particular records included were gathered from several sources: The sectional *Summaries of Climatological Data* give for some states the maximum 24-hour rainfalls. The monthly issues of *Climatological Data* by States yield numerous records, but for most States only the maximum fall for the month is given. Various articles in the MONTHLY WEATHER REVIEW include further records; and the monthly report on "River Stages and Floods" often mentions exceptionally heavy rainfalls, including sometimes the maxima in 24 hours. Although these data are only partly from the records of Weather Bureau Stations, these publications have led to correspondence with section directors who have often supplied official station records. A number of station directors have kindly supplied lists of official rainfalls of 10 inches or more in 24 hours for their areas. Finally, J. B. Kincer, chief of the Climate and Crop Weather division of the Weather Bureau, supplied the revised records (including 1940) of maximum rainfalls at each of the present stations, and at some discontinued stations, for 39 States; these records include only the maximum and hence, since some stations have had more than one rainfall in excess of 10 inches, do not include all such occurrences.

The 293 official records here given do not, therefore, include even all the rains of this magnitude which have been recorded in the United States by the Weather Bureau since its establishment. Furthermore, exceptionally heavy rains are usually limited to a small area, and probably the majority of them do not affect any Weather Bureau gages. Various evidence, including the numerous unofficial records mentioned from time to time in the MONTHLY WEATHER REVIEW, indicates that rainfalls in excess of 10 inches in 24 hours occur in some areas considerably more widely or frequently than the official records suggest. For example a rainstorm near

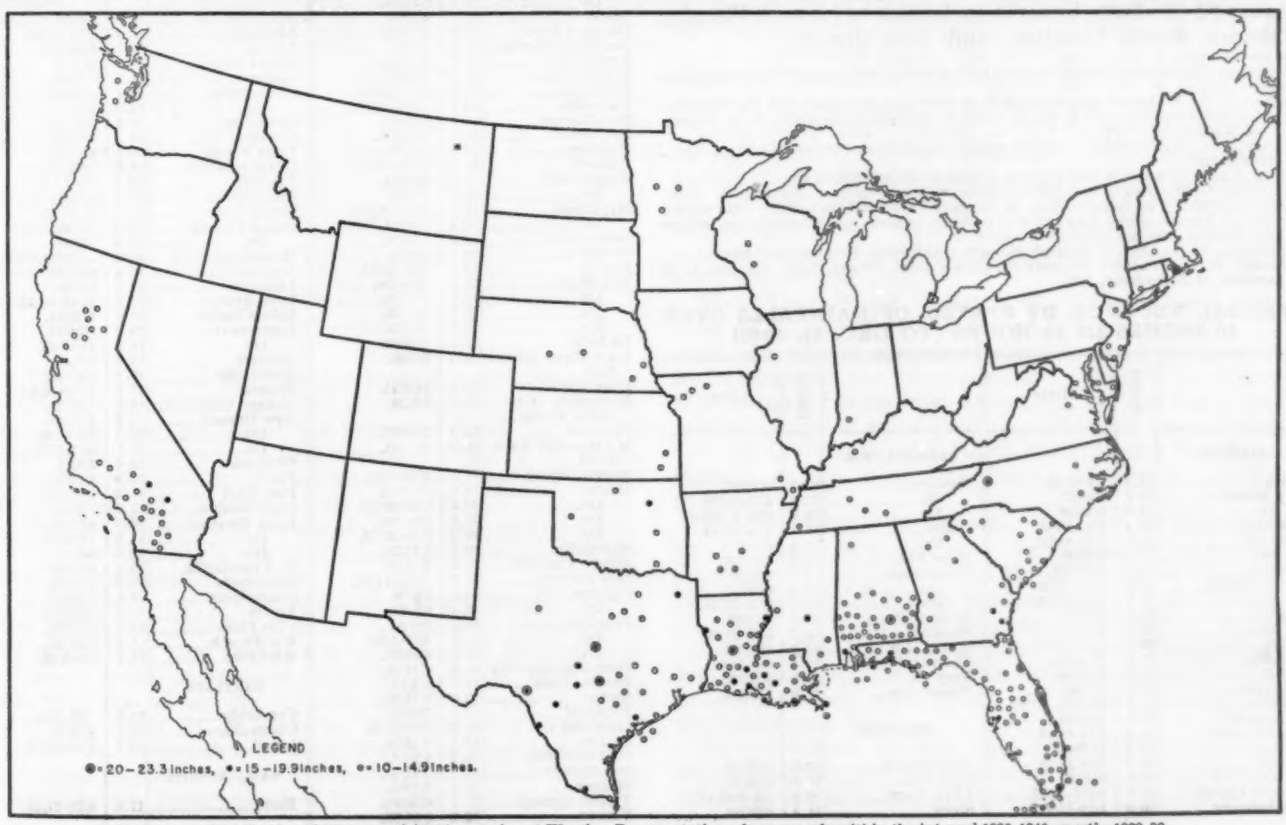

FIGURE 1.—Distribution of 293 torrential 24-hour rains at Weather Bureau stations, from records within the interval 1880–1940, mostly 1929–39.

Tulsa, Okla., on September 3–4, 1940, yielded only 1 official record in excess of 10 inches, but afforded 34 unofficial records of that magnitude (scattered over seven counties) that were acceptable to the Weather Bureau and were published in the MONTHLY WEATHER REVIEW for September 1940. Probably many excessive rains are never observed or recorded at all; and of course new records of heavy rainfalls are being established every year.

With a few exceptions, it is reasonable to assume that areas having few recorded storms have relatively few unrecorded storms. The chief exceptions to this generalization are the localities which possess few Weather Bureau stations. For example, the southern Appalachian Mountains presumably experience many more rainfalls in excess of 10 inches in 24 hours than the official records indicate. The occurrence of "flash floods" in streams leading from these slopes, and of landslides and other evidences of severe erosion imply occasional very heavy rains. Another area which presumably has more exceptionally heavy rains than the recorded number would indicate, is the State of Mississippi, which has far fewer records than the adjacent States.

The following table and accompanying map give by States the records of rainfalls in excess of 10 inches in 24 hours that were available to the writer.[1] Seven of these records are in excess of 20 inches in 24 hours, namely 23.3 inches at New Smyrna, Fla., 23.1 inches at Taylor, Tex.; 22.2 inches at Altapass, N. C.; 21.4 inches at Alexandria, La.; 20.4 inches at Smithville, Tex.; 20.1 inches at Montell, Tex.; and 20.0 inches at Elba, Ala.

Some of these official records represent duplication in that they were established at the same time that other records were established. For example, the storm of March 14–15, 1929, brought 10-inch rains to 8 Alabama Weather Bureau Stations, and the tropical cyclone of August 12–19, 1939, brought such rains to parts of Florida, Alabama, South Carolina, and New Jersey.

[1]Previous discussions of various types of excessive rains will be found in the following papers:

Kincer, J. B.: Maximum precipitation in 24 hours and in 1 hour, figs. 70, 75 of Precipitation and Humidity, sec. A, pt. 11; Atlas of American Agriculture, U. S. Department of Agriculture, 1922.

Henry, A. J.: Distribution of excessive rainfalls in the United States, MO. WEA. REV., 56: 355–363, 1928.

Ibid: Excessive rains in Southeastern Alabama, 57: 319–322, 1929.

Mindling, G. W.: Heavy Rainfall in Georgia (with some data on other States). idem. 61: 295–299, 1933. Two records which he mentions have not been located. He reports that Oregon has one official record of 12.18 inches in 24 hours and Tennessee one of 14.98 inches. Neither date not place are mentioned.

Theaman, J. R.: Heavy Rainfall Records (pamphlet), Indianapolis, 1931.

Yarnell, D. L.: Rainfall Intensity-Frequency Data, Miscel. Publ. No. 204, U. S Department of Agriculture, 1935.

OFFICIAL RECORDS, BY STATES, OF RAINFALLS OVER 10 INCHES IN 24 HOURS (TO DEC. 31, 1940)

	Inches	Date
ALABAMA		
Alaga	12.7	7/7–8/16.
Bay Minette	10.5	9/28/17.
Do	12.0	9/20/26.
Brantley	10.7	3/15–16/38.
Brewton	13.0	3/14–15/29.
Do	12.6	9/20/26.
Clanton	11.2	7/6–7/16.
Coffee Springs	14.1	3/14–15/20.
Do	11.1	4/22–23/28.
Daphne	12.0	8/15/01.
Do	10.0	9/27/06.
Elba	20.0	3/14–15/29.
Eufaula	10.9	7/7–8/16.
Eutaw	12.6	4/16/60.
Evergreen	11.9	7/6/16.
Geneva	11.0	3/15/29.
Livingston	10.0	4/17/00.
Marion (near)	11.5	8/14–15/39.
Millry	10.3	11/20/34.
Mobile	11.6	3/14–15/29.
Do	13.0	6/26/00.
Mobile Airport	10.6	10/17–18/37.
Montgomery	10.0	1/12–13/92.
Newton	10.3	3/22/97.
Do	11.8	3/14–15/29.
Do	10.9	8/31 & 9/1/37.
Ozark	13.4	3/14–15/29.
Do	10.4	9/1/37.
River Falls	11.2	3/15/29.
Robertsdale	12.5	7/5/16.
Do	17.5	9/28/17.
Do	11.7	9/20–21/26.
Seven Hills	13.3	7/16/31.
Silverhill	12.7	9/20–21/26.
Spring Hill	12.0	9/21/26.
Thomasville	12.4	6/4–5/28.
Troy No. 1	10.2	9/20/26.
Tuscumbia	10.0	7/10/92.
ARKANSAS		
Arkadelphia	12.0	6/28/05.
Jessieville	11.0	4/20/27.
Little Rock	10.0	4/8–9/13 (?)
Story	11.4	4/21/24.

OFFICIAL RECORDS, BY STATES, OF RAINFALLS OVER 10 INCHES IN 24 HOURS (TO DEC. 31, 1940)—Continued

	Inches	Date
CALIFORNIA		
Bear Valley Dam	12.9	1/17/16.
Big Bear Dam	15.1	3/2/38.
Campo	11.5	8/12/91.
Cuyamaca	12.4	2/22–23/91.
Do	12.8	2/16/27.
Glen Ranch	12.4	1/10/10.
Helen Mine	10.4	2/24/17.
Do	10.4	12/31/13.
Inskip	10.4	12/31/13.
Julian	10.4	2/16/27.
La Porte	12.0	5/18/11.
Lytle Creek	13.0	1/17/16.
Magalia	10.9	1/18/06.
Mono Rach	11.5	3/12/06.
Mount St. Helena	14.7	4/20–21/80.
Mount Wilson	12.8	3/1–2/21.
Do	11.8	3/2/28.
Nellie	11.2	1/17/16.
Opids Camp	14.9	3/2/38.
Do	10.0	12/31/33.
Rialto	12.9	1/17/16.
San Gabriel Dam	13.4	3/2/38.
Stirling City	10.1	12/31/13.
Squirrel Inn	16.8	1/17/16.
West Branch	10.0	1/31/13.
CONNECTICUT		
Bridgeport	11.0	7/29/05.
FLORIDA		
Allapattah	10.1	10/19/24.
Apalachicola	10.1	9/—/06.
Do	11.7	9/13–14/32.
Bartow	11.5	9/5/33.
Belle Glade	10.9	11/7/32.
Blountstown-Bristol	10.0	9/20/26.
Bonifax	16.1	7/7/16.
Caryville	10.0	8/14/39.
Chapman Field Garden.	10.1	9/29/29.
Clermont	12.5	9/25–26/94.
Do	10.9	9/5/33.
Cottage Hill	13.1	10/5/34.
Davenport	11.8	9/5/33.
Do	14.1	6/15/34.
Davie	10.2	9/29/37.
Daytona Beach	12.9	10/10/24.
De Funiak Springs	10.8	7/8/16.
Everglades	12.5	6/14/36.
Federal Point	11.3	9/26/94.
Fellsmere	10.5	9/21–22/29.
Fernadine	13.1	10/20–21/82.
Fort Meyers	11.7	6/13/01.
Fort Pierce	10.0	10/13/36.
Garniers	10.1	10/5/34.
Hilliard	12.5	8/28–29/11.
Homestead	11.5	10/5/33.
Do	10.0	9/3/35.
Hypoluxo	16.8	10/15–16/10.
Do	10.4	9/24/94.
Indiantown	12.0	7/31/33.
Inverness	10.5	9/5/33.
Jupiter	13.2	9/17–18/04.
Key West	11.2	10/—/09.
Do	12.0	9/—/19.
Do	15.1	11/ /25.
Do	13.5	10/4/33.
La Belle	12.5	6/15/31.
Lake Alfred-Lucern Park.	10.2	9/5/33.
Long Key	11.8	11/4/35.
Mammoth Grove (Lake Wales).	10.0	8/8/28.
Mayport	12.2	7/29/82.
McDonald-Zellwood.	10.9	9/—/94.
Merrits Island	11.1	10/3–4/99.
Miami	14.1	11/30/25.
Do	10.6	9/28–29/29.
Do	10.3	9/6–7/31.
Do	10.2	8/29–30/32.
Monticello	10.5	8/15/28.
Mount Pleasant	10.4	9/16/24.
New Smyrna	23.2	10/10–11/24.
Panama City	10.0	8/6/06.
Do	10.5	8/6/32.
Pensacola	10.7	6/—/87.
Do	17.1	10/4–5/34.
Do	10.6	4/24/37.
Perry-Fenholloway	10.5	6/14/34.
Pinellas Park	10.3	8/2/15.
Quincy	12.9	9/15/94.
Rockwell	12.0	7/2/09.
Sebastian	12.2	10/2–3/09.
St. Leo	13.1	6/15/34.
St. Petersburg	15.5	8/2/15.
Stephenville	14.0	7/11/98.
Sumner	13.3	6/1/01.
Tarpon Springs	11.1	6/30/09.
Vernon	12.2	8/31/37.
FLORIDA—con.		
Wausau	15.0	11/23/07.
West Palm Beach	12.0	7/31/33.
GEORGIA		
Blakely	10.9	3/14–15/29.
Cornelia	10.5	9/30/36.
Glennville	15.0	9/27/29.
Greensboro	10.4	8/13/40.
Griffin	10.4	8/8/83.
Meldrim	10.5	9/5–6/33.
St. George	18.0	8/28/11.
Savannah	10.0	9/15–16/24.
Do	11.4	9/17–18/28.
ILLINOIS		
La Harpe	10.2	6/10/05.
INDIANA		
Princeton	10.5	8/6/05.
IOWA		
Bonaparte	12.1	6/10/05.
Chariton (near)	11.2	8/27/03.
Hopeville	10.3	8/26–27/03.
Keosauqua	11.2	6/10–11/05.
Larabee	13.0	6/24/91.
Muscatine	10.7	8/10/15.
Primghar	13.0	7/14–15/00.
Sioux Center	11.7	9/17–18/26.
KANSAS		
Moran	10.3	9/7/15.
Neosha Falls	13.0	9/12/26.
KENTUCKY		
Greenville	10.1	6/21/35.
LOUISIANA		
Abbeville	17.5	8/9/40.
Alexandria	21.4	6/15–16/86.
Angola	11.1	5/20/35.
Bella Chasse	15.4	10/2/37.
Cameron	14.2	9/18/08.
Cheneyville	13.1	6/16/86.
Do	11.0	3/27/14.
Covington	10.4	6/5/28.
Crowley	19.7	8/9/40.
Delta Farms	10.5	4/15/27.
Donaldsonville	14.5	8/26/26.
Franklin	12.3	9/6–7/93.
Franklinton	10.2	9/30/15.
Grand Cane	11.6	11/23/40.
Grand Coteau	16.0	8/9/40.
Do	10.3	5/6/35.
Hempstead	16.0	11/24/40.
Jennings	13.9	8/15/38.
Lafayette	19.6	8/9/40.
Lake Arthur	14.7	11/12–13/32.
Lake Charles	10.0	4/27/24.
Logansport	18.0	7/24/33.
Do	11.3	11/23/40.
Melville	12.3	5/6/35.
Merryville	10.1	4/27/14.
Monroe	12.1	12/29–30/84.
Morgan City	15.6	4/15/27.
New Orleans	14.0	4/15/27.
Do	13.0	9/6–7/29.
Do	13.1	10/1–2/37.
Okaloosa	12–6	3/9/78.
Pharr	18.5	4/15/27.
Port Eads	11.3	10/1/98.
Plain Dealing	12.0	7/6/20.
Point Pleasant	16.5	6/12/78.
Do	13.5	12/19/82.
Do	12.3	9/5/85.
St. Francisville	13.5	9/21/09.
Shreveport	12.4	7/24/33.
Simmesport	14.1	5/20/35.
Venice	10.1	12/26/04.
Ville Platte	10.5	8/15/38.
Woodworth	11.2	7/25/33.
Winnfield	11.1	1/4–5/39.
MARYLAND		
Cambridge	10.3	9/5–6/35.
Cheltenham	11.7	8/12/28.
Jewell	14.7	7/26–27/97.
MASSACHUSETTS		
Barre	11.8	9/20–21/38.

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OFFICIAL RECORDS, BY STATES, OF RAINFALLS OVER 10 INCHES IN 24 HOURS (TO DEC. 31, 1940)—Continued

	Inches	Date
MINNESOTA		
Bagley	10.0	7/20/09.
Beaulieu	10.8	7/20/09.
Mahnomen	10.8	7/20/09.
MISSISSIPPI		
Bay St. Louis	10.1	5/17/32.
Edwards	16.7	7/7–8/92.
Merrill	12.2	7/5–6/17.
	12.3	7/—/16.
MISSOURI		
Bethany	10.1	7/—/—.
Fisk	10.3	7/4/37.
Grant City	12.2	7/—/—.
Marysville	10.8	7/—/—.
New Madrid	10.0	9/2–3/36.
MONTANA		
Circle (near)	11.5	6/20/21.
NEBRASKA		
Beatrice	11.1	7/23/11.
Greeley Center	12.0	6/5/96.
Loup City	10.1	6/5/96.
Plattsmouth	10.7	7/6/98.
NEW JERSEY		
Clayton	10.5	9/1/40.
Paterson	11.4	10/8–9/03.
Pleasantville	10.2	8/19–20/39.
Tuckerton	14.8	8/19–20/39.
NEW YORK		
Salisbury Mills	10.5	10/9/03.
NORTH CAROLINA		
Altapass	22.2	7/14–15/16.
Blantyre	13.2	7/16/16.
Elsworth	13.0	9/15–16/81.
Falkland	13.5	8/4–5/94.
OKLAHOMA		
Enid	10.8	8/16–17/32.
Cheyenne	13.8	4/3–4/34.
Hugo	10.0	5/11/20.
Meeker	12.2	6/3/32.
Sapulpa	15.5	9/3–4/40.
RHODE ISLAND		
Westerly	12.2	7/—/32.
SOUTH CAROLINA		
Anderson	11.6	8/25/08.
Beaufort (near)	10.8	8/31/98.
Do	10.8	8/11/40.
Charleston	10.6	9/5–6/33.
SOUTH CAROLINA—continued		
Clemson College	10.0	9/30/36.
Connors	12.4	8/27–28/93.
Darlington	10.1	7/15/16.
Effingham	13.2	7/15/16.
Florence	11.1	7/14–15/16.
Kingstree	12.6	7/15/16.
Laurens	10.7	9/26/29.
Liberty	11.1	8/25/08.
Manning	13.2	8/27–28/93.
Port Royal	10.8	8/31/98.
St. George	10.2	8/26–27/93.
Summerville	10.2	8/11–12/40.
TENNESSEE		
Cedar Hill	10.0	6/17–18/34.
McMinnville	11.0	3/28/02.
Memphis	10.5	11/20–21/34.
Rock Island	10.3	3/22–23/29.
TEXAS		
Austin	19.0	9/9–10/21.
Brachsville	11.0	10/1/81.
Brownsville	10.0	9/5–6/33.
Cuero	12.4	6/29–30/40.
Eagle Pass	15.6	6/29/36.
Freeport	12.0	7/22/33.
Fort Clark	18.0	6/14/89.
Galveston	14.3	7/13–14/00.
Do	14.1	10/7–8/01.
Do	10.5	1/24/40/
Hallettsville	11.3	7/1/36.
Hillsboro	11.3	9/27/36.
Hills Ranch	16.0	9/10/21.
Kaufman	14.2	8/22–23/08.
Do	14.2	9/27/36.
La Grange	10.0	6/29–30/40.
Matagorda	15.7	5/1/11.
Mercedes	15.0	9/5/33.
Mexia	11.8	9/4/32.
Montell	20.1	6/28/13.
Richmond	11.6	7/12/39.
Rockland	10.1	5/27–28/29.
San Angelo	11.8	9/15/36.
San Benito	12.7	9/5/33.
Sinton	12.4	4/28/30.
Smithville	20.4	6/29–30/40.
Taylor	23.1	9/9–10/21.
Terral	18.0	2/22–23/79.
Uvalde	13.5	7/2/32.
Yoakum	10.7	4/25/38.
VIRGINIA		
Guinea	11.2	8/24/06.
WASHINGTON		
Quinault	12.0	1/21/35.
Spruce	11.6	1/21/35.
WISCONSIN		
Butternut	10.2	7/24–25/97.
Merrill	11.3	7/23–24/12.

The symbols on the map are located as exactly as possible, but in certain crowded areas they depart slightly from the true positions; for example, Alabama has 38 such records, all but one in the southern half of the State, and 13 are in the small southwestern area which lies west of Florida, near Mobile. Ten other records were established in the extreme southeastern corner of the State. Other crowded areas are in southern and eastern Florida, and in southeastern Texas.

From this map, it is evident that the southern part of the South has had many rains in excess of 10 inches in 24 hours, and that there is a rapid decline in frequency within a hundred miles or so of the coast, not only along the Gulf but along the Atlantic and the Pacific. In the interior, there is in general a progressive northward decline in the number of these rains; the chief exceptions are local increases in the Southern Appalachians and near the Balcones Escarpment of the Texas Plateau.

AN ANALYSIS OF THE STORMS

The following analysis is of the *storms* which brought rainfalls in excess of 10 inches in 24 hours, not of the *individual records;* in most cases, the grouping is in accordance with the Weather Bureau report, although in a few cases two records were counted as one storm merely because near together in time and place, and may sometimes have been separate thunderstorms. Of the 204 storms here classified, 163 occurred in the South, 25 in the North, and 16 in the West. Of the 39 storms which yielded more than 15 inches, the South had 37 and California 2. As to season and month of occurrence (of those for which these data are available) the summer had 82 rains of more than 10 inches, autumn 77, spring 29, winter 16. September had 48, July 33, June 22, August 27, October 18, March 13, November 11, April 8, and May 8; the winter months each about 4. Of the 16 winter rains, the South had 7, California 8, Washington 1. Of the 29 spring rains, the South had 23, California 5, and Missouri 1. Of the 82 summer rains, the South had 48, the North 19. Of the 77 autumn rains, the South had 68, the North 8, the West 1. Thus of the 10-inch rains in the North, about four-fifths occurred in summer; but in the South, only about one-third.

The 37 rains of over 15 inches in 24 hours in the South occurred in 9 of the 12 months; June, September, and October had 6 each, August 5, November 5, July 4, April 2; and February, March, and May, each 1.

REGIONAL CONTRASTS IN THE FREQUENCY OF TORRENTIAL RAINS

The map also shows that the various parts of the United States differ sharply in the number of official records of rains in excess of 10 inches in 24 hours. All of the records of more than 20 inches in 24 hours, and most of those of 15 to 19.9 inches are in the southeastern quarter of the country. Moreover, that region also has a predominant share of the records of 10 to 15 inches.

Because of the variation in the length of the different rainfall records, and in the number of recording stations, and analysis of all of the records entered on the map would be less illuminating than an analysis of more closely comparable data. Hence the following analysis has been made of all the records in the issues of *Climatological Data* for 1939–37 and 1939.

The "Deep South," that is the 5 States bordering the Gulf of Mexico plus Georgia and South Carolina, had a total of 8 official records of rainfalls of 15 inches or more in 24 hours in that 10-year period. The "Upper South," that is the 8 States from Oklahoma to Maryland, had no official record of rainfall of this intensity in that decade, nor did the North (the North-Central and Northeastern States), or the West (the Rocky Mountain and Pacific States).

The Deep South had 67 official records of rainfalls of 10 to 14.9 inches in 24 hours in the decade, or an average of more than 6 per year. The Upper South had 8; and the North, 4, of which 2 were in Missouri and 2 in New Jersey. The West (Washington) had one.

Of all official records of rains of over 10 inches in 24 hours, the Deep South had in that decade about 10 times as many as the Upper South and 15 times as many as all the North and West.

In proportion to area, the Deep South had in that 10-year period about 12 times as many official records of rains of over 10 inches in 24 hours as did the Upper South,

and more than 100 times as many as did the North (21 States). None were recorded from the Rocky Mountain States and only one from the Pacific States during these 10 years.[2]

Several factors contribute to the greater frequency of torrential rains in the Southern States. The most important probably is the fact that tropical cyclones are relatively much more frequent there. A large proportion of the rains here studied occurred in tropical cyclones, although only a few in storms of hurricane intensity. An analysis of the maps showing the paths of LOWS published in the MONTHLY WEATHER REVIEW for the decade 1919–28 showed an annual average of 21 tropical disturbances entering the South or passing northward near the Atlantic coast.[3] This average was approximately the same as that for 1892–1912. Tropical cyclones usually lose intensity soon after crossing the coast; and the sharp decline in the number of excessive rains within about 100 miles from the Gulf and Atlantic coast is presumably largely due to this influence.[4]

Another reason for the greater frequency of torrential rainfalls in the South than in the North is the greater number of thunderstorms there. The South has an average of about twice as many thunderstorms as the North; and part of it has more than three times as many as a large part of the North.[5] Although thunderstorms characteristically yield heavy downpours, seldom in the North do they bring to any locality more than 4 to 6 inches in 24 hours; but in the South they frequently yield much heavier rainfalls.

The considerable number of tropical cyclonic disturbances in the South, in addition to the warm-front and cold-front thunderstorms, also makes it more likely that a given locality in the South will have two severe thunderstorms within a 24-hour period than is true for the North. A number of the heaviest rainfall records in the South, and a few of those in the North, resulted from two severe thunderstorms in one day.

Topographic conditions also help to explain the distribution of exceptionally heavy rains. The southern Appalachian mountains comprise a region of heavy rainfall (the greatest in eastern United States) partly because it has orographic as well as other types of rainfall. Several of the rains here discussed occurred in that region.

Orographic rains are also important in the San Gabriel range and other mountains near Los Angeles, where a number of exceptionally heavy rains have occurred, for example those of December 30–31, 1933, and March 2, 1938. Orographic influences are likewise sometimes significant elsewhere in California, and in western Oregon and Washington.

A topographic feature of importance in Texas is the Balcones Escarpment of the plateau region of Texas, especially of the Edwards Plateau. It is just west of several stations which have had exceptionally heavy rains, for example, Taylor, Austin, Smithville, and Montell, each of which has had rains in excess of 19 inches in 24 hours. These rains, however, were not orographic rains, as they occured below, not on or above the slope.[6] This escarpment seems sometimes to interfere with the northward migration of tropical disturbances, thus concentrating their rainfall.

Topographic influences are also sometimes evident near the Ozarks and neighboring elevations, as a number of exceptionally hard rains have occurred on their southern margin. In the Ozarks themselves, and in the adjacent area to the north, there have been relatively few records of 10-inch rains. Similarly, the region to the northwest of the Southern Appalachians, that is eastern Tennessee and Kentucky and northwestern Alabama, has had fewer such recorded rains than the zone nearer the Mississippi River. These areas of fewer hard rains may comprise a sort of "rain-shadow."

Finally, the large areas which lack any records of rainfall in excess of 10 inches in 24 hours merit a few words. In the Great Plains and Rocky Mountain States, the air generally is not humid enough to yield such large rainfalls, partly because of remoteness from effective sources of moisture. Of importance in the Great Plains also is the relatively rapid eastward movement of the rain-producing storms. In the Rocky Mountains, of possible significance is the fact that the records are nearly all from the valleys, not from well up on the mountain sides where the heaviest rains occur.

[2] Southern California had a rainstorm on March 2, 1938 of these proportions, which is described by Daingerfield, L. H., in the MO. WEA. REV., 66:139–143. However, 1938 is not one of the 10 years especially studied.

[3] Visher, S. S.: Frequencies of Tropical Cyclones especially those of minor importance. MO. WEA. REV. 58: 62–64, 1930.

[4] Idem. Effects of Tropical Cyclones on the Weather of Midlatitudes. Geographical Rev. 15: 106–114, 1925. Also, Tropical Cyclones of the Pacific, Bishop. Museum Bull. No. 20, 165 pp., Honolulu, 1925.

[5] Alexander, W. H.: The Distribution of Thunderstorms in the United States, 1904–33. MO. WEA. REV. 63: 157–158, 1935.

[6] The Taylor, Tex., rain was the subject of an article in the MO. WEA. REV. 49: 496–497, 1921, by J. R. McAuliffe, who reported that the 23.1 inches received at Taylor fell in about 15 hours, (10.3 in 3 hours), and that the rainfall a short distance from Taylor was greater, possibly 30 inches. (Numerous tropical weather stations have recorded more than 30 inches in 24 hours; Baguio, Luzon, as much as 46 inches.)

THE RECORD RAINFALLS OF THE WORLD

The following chart, which is self-explanatory, has been compiled in the Hydrometeorological Section of the U. S. Weather Bureau. The authorities for the data are as follows, where (1) denotes John R. Theaman, *Excessive Rainfall Records*, 1929; and (2) refers to the MONTHLY WEATHER REVIEW, May 1919.

Opid's Camp, Calif	Apr. 5, 1926	(1).
Porto Bello, R. P.*	Nov. 29, 1911	(2).
Galveston, Tex	June 4, 1871	(2).
Curtea-de-Arges, Romania.	July 7, 1889	(2).
Guinea, Va	Aug. 24, 1906	(2).
Catskill, N. Y	July 26, 1819	*American Journal of Science and Arts*, vol. IV, 1822, pp. 124–142.
Campo, Calif	Aug. 12, 1891	(2).
Concord, Pa	Aug. 5, 1843	*Proceedings of the Delaware County Institute of Science*, October 1910.
Bassetere, St. Kitts, West Indies.	Jan. 12, 1880	(2).
Cherrapunji, India	June 14, 1876	(1).
Baguio, P. I	June 14–15, 1911	(1).
Cherrapunji, India	June 14–15, 1876	(2).
Funkiko, Formosa	July 18–20, 1913	(1).
Cherrapunji, India	June 12–15, 1876	(1).
Do	Aug. 1841	(1).
Silver Hill Plantation, Jamaica.	Nov. 4–11, 1909	(1).
Cherrapunji, India	Aug. 1841	(1).
Do	July 1861	(1).
Do	1861	(1).

*See also MO. WEA. REV., May 1920, vol. 48, pp. 274–276, Benjamin C. Kadel, "The most intense rainfall on record."

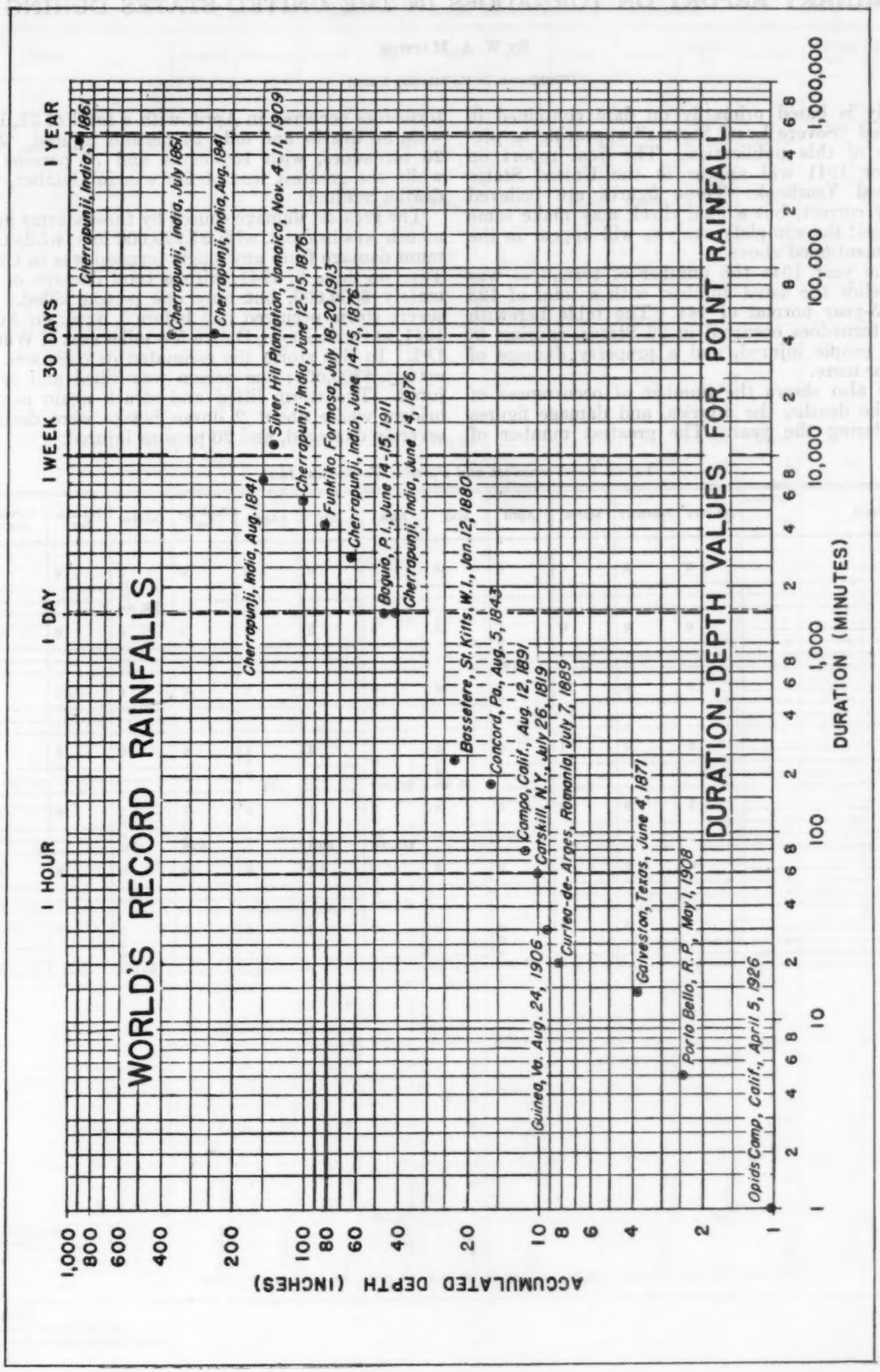


FIGURE 1.—Distribution of 293 torrential 24-hour rains at Weather Bureau stations, from records within the interval 1880–1940, mostly 1920–39.

PRELIMINARY REPORT ON TORNADOES IN THE UNITED STATES DURING 1941

By W. A. MATTICE

[Washington, D. C., February 1, 1942]

This study is based primarily on data contained in tables entitled "Severe Local Storms" appearing in previous issues of this publication. The final report on tornadoes for 1941 will appear in the United States Meteorological Yearbook. These figures are believed substantially correct, but a final check may make some minor changes; the complete analysis will appear in the publication mentioned above.

During the year 1941 the number of tornadoes was somewhat below the usual number, with a total of 123 against a 25-year normal of 141. The table herewith shows that tornadoes occurred in 26 States, causing 48 deaths, 440 people injured, and a property damage of $4,334,050, or more.

The table also shows the number of occurrences of tornadoes, the deaths, the injuries, and damage figures by States during the year. The greatest number of tornadoes occurred in April, with a total of 31, but there were no deaths and only 24 persons injured. June had 26 tornadoes, with 15 deaths and 76 persons injured, while the greatest loss of life was in October, when 24 deaths resulted.

The greatest damage caused by these storms in any one month was in June, with $1,229,000 loss; while the maximum damage from any single tornado was in Clarendon, Tex., on June 9, 1941, with a total damage of approximately $500,000, but only one person killed. Another severe storm occurred just before 1 p. m. on August 25, 1941, at Swedesboro, Del., a few miles east of Wilmington, Del. In this storm the estimated damage was approximately $300,000; one person was killed and several injured. The storm lifted and struck again near Woodbridge, where about 2 dozen homes were destroyed or severely damaged, and 20 persons injured.

TABLE 1.—*Tornadoes and Possible Tornadoes, 1491*

State	January	February	March	April	May	June	July	August	September	October	November	December	Year
Alabama:													
Number	0	0	0	0	0	0	0	0	0	2	0	0	2
Deaths										19			19
Injuries										94			94
Damage										$200,000			$200,000
Arkansas:													
Number	0	0	0	1	0	0	0	0	0	0	0	0	1
Deaths				0									0
Injuries				0									0
Damage				$5,000									$5,000
California:													
Number	0	0	0	1	0	0	0	0	0	0	0	0	1
Deaths				0									0
Injuries				1									1
Damage				(1)									(1)
Colorado:													
Number	0	0	0	0	2	1	0	1	0	0	0	0	4
Deaths					0	0		0					0
Injuries					0	0		0					0
Damage					$1,500	$40,000		(2)					$41,500
Florida:													
Number	0	0	0	0	0	2	1	0	1	1	0	0	5
Deaths						0	0		0	0			0
Injuries						20	0		1	0			21
Damage						$15,000	$600		$600	$100			$16,300
Georgia:													
Number	0	0	0	0	0	1	0	0	0	0	0	0	1
Deaths						0							0
Injuries						0							0
Damage						$15,000							$15,000
Illinois:													
Number	0	0	0	2	0	0	0	0	0	2	0	0	
Deaths				0						0			
Injuries				4						0			
Damage				$17,000						$5,000			$22,000

TABLE 1.—*Tornadoes and Possible Tornadoes, 1941*—Continued

State	January	February	March	April	May	June	July	August	September	October	November	December	Year
Iowa:													
Number	0	0	0	11	0	0	0	0	2	11	0	0	24
Deaths				0					0	0			0
Injuries				4					6	1			11
Damage				$207,500					$215,000	$86,000			$508,50
Kansas:													
Number	0	0	1	2	2	8	2	3	0	1	0	0	19
Deaths			0	0	0	8	0	0		0			8
Injuries			0	5	3	20	1	6		0			35
Damage			$50	$100,300	$100,000	$340,500	$6,500	$70,000		(2)			$617,350
Louisiana:													
Number	2	0	0	0	0	2	0	0	0	2	0	1	7
Deaths	0					3				1		0	4
Injuries	5					10				12		0	27
Damage	$500					$80,400				(2)		$15,000	$95,900
Delaware:													
Number	0	0	0	0	0	0	1	2	0	0	0	0	3
Deaths							0	1					1
Injuries							0	20					20
Damage							(1)	$405,300					$405,300
Michigan:													
Number	0	0	0	1	0	0	0	0	0	0	0	0	1
Deaths				0									0
Injuries				3									3
Damage				$100,000									$100,000
Minnesota:													
Number	0	0	0	0	3	0	0	0	3	1	0	0	7
Deaths					1				5	0			6
Injuries					0				50	0			50
Damage					$210,000				$500,000	$3,000			$713,000
Mississippi:													
Number	0	1	0	0	0	0	0	0	0	2	0	0	3
Deaths		0								4			4
Injuries		0								136			136
Damage		$1,000								$350,000			$351,000
Missouri:													
Number	0	0	0	1	0	0	1	0	0	0	0	0	2
Deaths				0			0						0
Injuries				4			0						4
Damage				$200,000			(3)						$200,000
Nebraska:													
Number	0	0	0	3	1	0	0	0	0	0	0	0	4
Deaths				0	0								0
Injuries				0	0								0
Damage				$23,000	$20,000								$43,000
Massachusetts:													
Number	0	0	0	0	1	0	0	0	0	0	0	0	1
Deaths					0								0
Injuries					0								0
Damage					(4)								(4)
New Mexico:													
Number	0	0	0	0	4	1	1	0	0	0	0	0	6
Deaths					0	0	0						0
Injuries					0	0	0						0
Damage					$1,500	$100	$1,000						$2,600
Oklahoma:													
Number	0	0	0	3	3	2	0	0	0	0	0	0	8
Deaths				0	1	0							1
Injuries				0	3	3							6
Damage				$14,000	$47,000	$155,000							$216,000
Pennsylvania:													
Number	0	0	0	0	0	0	1	1	0	0	0	0	2
Deaths							0	0					0
Injuries							0	0					0
Damage							(1)	$100,000					$100,000
South Dakota:													
Number	0	0	0	0	0	1	0	0	0	0	0	0	1
Deaths						0							0
Injuries						0							0
Damage						(3)							(3)
Tennessee:													
Number	0	0	0	0	0	1	0	0	0	0	0	0	1
Deaths						0							0
Injuries						0							0
Damage						$50,000							$50,000
Texas:													
Number	0	0	0	3	0	7	0	0	0	0	0	0	10
Deaths				0		4							4
Injuries				3		23							26
Damage				$17,600		$533,000							$550,600
Utah:													
Number	0	0	0	0	1	0	0	0	0	0	0	0	1
Deaths					0								0
Injuries					0								0
Damage					$4,000								$4,000
Virginia:													
Number	0	0	0	0	0	0	0	1	0	0	0	0	1
Deaths								1					1
Injuries								0					0
Damage								$50,000					$50,000
Wisconsin:													
Number	0	0	0	3	0	0	0	0	1	0	0	0	4
Deaths				0					0				0
Injuries				0					2				2
Damage				$26,000					1,000				$27,000
United States: Number	2	1	1	31	17	26	7	8	7	22	0	1	123
Normal frequency	3	4	16	23	31	26	12	7	8	3	5	3	141
Deaths	0	0	0	0	2	15	0	2	5	24		0	48
Injuries	5	0	0	24	6	76	1	26	59	24		0	440
Damage	$500	$1,000	$50	$710,400	$384,000	$1,229,000	$8,100	$625,300	$716,600	$644,100		$15,000	$4,334,050

[1] Not estimated.
[2] Not estimated, small damage.
[3] Not estimated, considerable damage.
[4] No damage.

THE WEATHER OF 1941 IN THE UNITED STATES

By W. A. MATTICE

[Weather Bureau, Washington, D. C., February 1, 1942]

On the basis of weighted averages the year 1941 was practically normal in respect to mean temperature, the departure being less than 1° above the mean value of 53.7°. The extremes of temperature on the weighted basis were 55.6° in 1921, and 51.8° in 1917. The largest annual departures of temperature in the various sections for 1941 were +3.0° in Iowa, followed by +2.7° in North Carolina, and +2.5° in Minnesota and Wisconsin. The greatest negative departure was —1.4° in Arizona, with the remainder of the States all less than —1°.

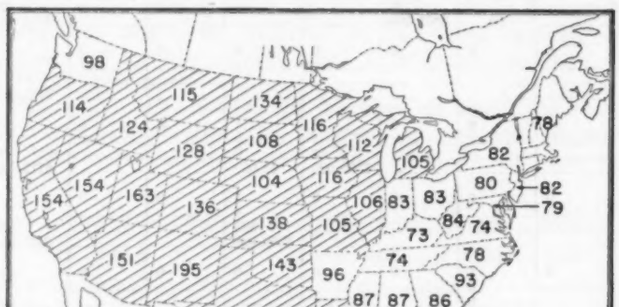


FIGURE 1.—Percentage of normal precipitation, 1941.

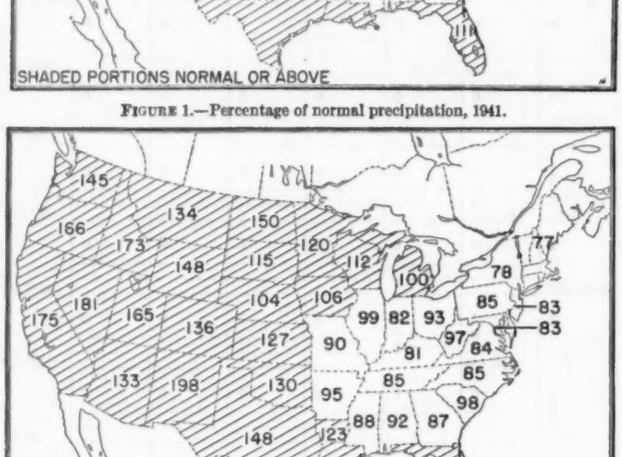


FIGURE 2.—Percentage of normal precipitation, April 1–September 30, 1941

The relatively warmest month was December, when every section showed positive departures from normal. In this month the greatest plus departure was 9.2° in North Dakota, while Iowa had 7.8° above, and Wisconsin 7.4° above normal. Other warm months were November, when only six States were below normal, May with two States below, and January, when subnormal departures were small. The relatively coldest month was March, with a number of States reporting 5° or more below the normal. In this month the relatively coldest State was West Virginia with 7.5° below normal temperature, while South Carolina and Georgia had 6.2° and 6.1° respectively, below normal. Maximum temperatures of over 100° began to be recorded in March, with 102° in Nevada; the last month with 100° or over was October. The extreme highest for the year was 124° at two stations in California in July. Maximum temperatures of 100° or over were reported from every State, except five of the New England group, with readings of as high as 110° to 112° general in the Great Plains.

Subzero temperatures were reported from some portions of the country into April, and were noted in higher elevations of the Rocky Mountain States in October. Temperatures as low as zero were reported south to Kentucky and Missouri in January, and to Virginia and Missouri in February, while an extreme of —6° was noted in North Carolina in March. Freezing weather was reported from the Gulf States in March, with a minimum of 22° in northern Florida. The lowest temperature for the year was —43° at Taylor Park, Colo. on January 3, 1941. The record extremes for the country are 134° at Greenland Ranch, Death Valley, Calif. on July 10, 1913, and of —66° at Riverside Ranger Station, Yellowstone National Park, Wyo., on February 9, 1933.

In general, the temperatures of 1941 followed the general trend since the beginning of the century, with a tendency to above-normal warmth very marked in all seasons of the year. The winter was slightly colder than normal in parts of the Atlantic area, but in all other sections above-normal warmth prevailed, the plus departures being especially large in the western half of the country. The spring season was slightly cooler than normal in the South, but was substantially warmer than normal in the northern half of the country. Summer was somewhat cooler than usual in the Southwest and parts of the Great Basin, but elsewhere it was relatively warm, especially in the northern and western portions of the country.

See table 1 and the Annual Temperature Departure chart for detailed supplements to these remarks.

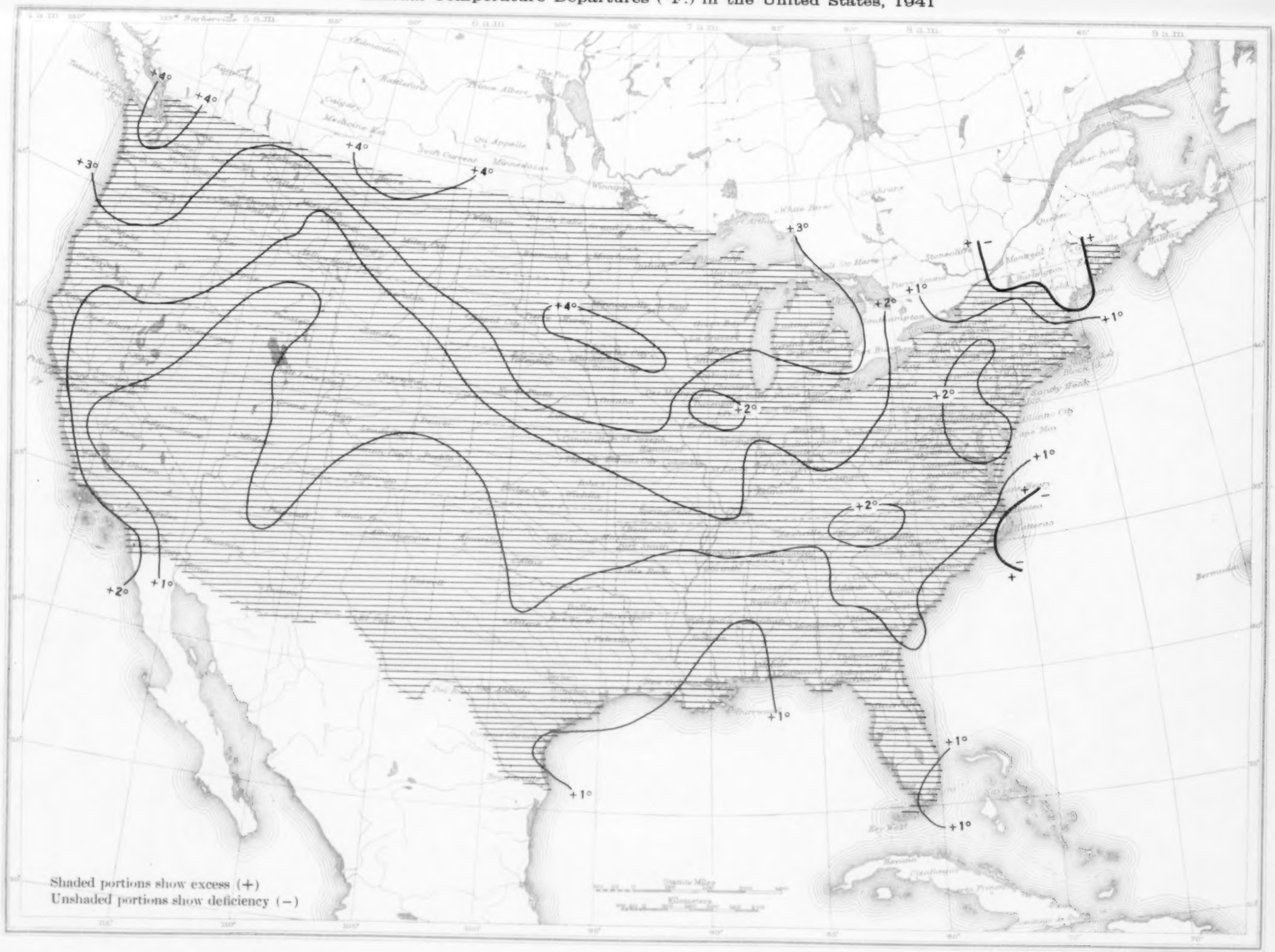
The average annual precipitation found by weighting the State areas was 32.36 inches or somewhat over 3 inches higher than the mean for the entire country for the period 1886 to 1940, inclusive. For the country as a whole 1941 was the third wettest year of record, exceeded only in 1905 with 32.69 inches, and 1915 with 32.74 inches.

Figure 1 and table 2 show the percentage of annual precipitation for the year as a whole and by months. For the entire year the relatively wettest State was New Mexico with 195 percent of the normal annual amount. Other States showing over 50 percent above the usual annual normal were Utah with 163 percent, Nevada and California with 154 percent each, and Arizona with 151 percent. With the exception of Washington, which was slightly below normal, the subnormal rainfall of the year was confined almost exclusively to areas east of the Mississippi River, although Arkansas was 4 percent below normal. The relatively driest States were Kentucky, Tennessee, Virginia, and New England, ranging from 22 to 27 percent less than the normal amount.

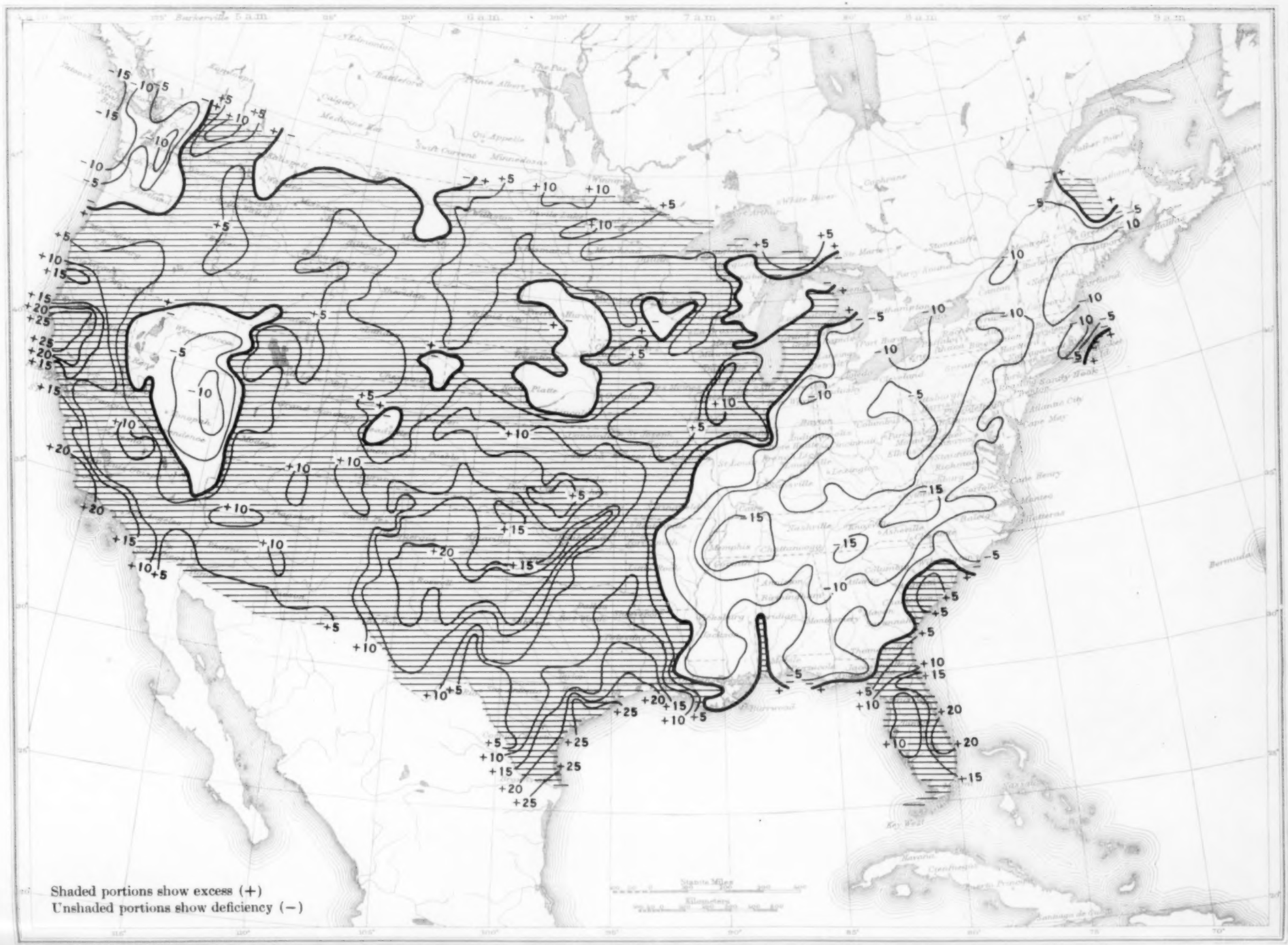
Probably the wettest month of the year was June, when 15 States reported 150 percent, or more, of normal. The relatively wettest State in this month was Utah with 302 percent of the normal June amount; Oregon, Nevada, and Idaho also reported over twice the normal. Another wet month in some portions of the country was August, with 6 States reporting over twice the normal; the relatively wettest State this month was Oregon, with 352 percent of normal. In September, New Mexico reported 371 percent of the normal amount, while in October 14 States had over twice the normal. In this month Oklahoma reported 382 percent of normal, Missouri 353 percent, Illinois 354 percent, and Kansas 330 percent of normal.

Annual Temperature Departures (°F.) in the United States, 1941

Annual Temperature Departures (°F.) in the United States, 1941



Annual Precipitation Departures (inches) in the United States, 1941



The greatest monthly fall at any station in the United States was 30.76 inches at West Branch, Calif., in December, while 29.12 inches were recorded at a station in this State in January. In October, the monthly totals were extremely heavy in the central and lower Great Plains, as well as the central and lower Mississippi Valley, with extremes in six States throughout this area over 16 inches. With one exception, each month had some station with no rain; Peru, N. Y., reported 0.04 inches in April 1941, for a country-wide minimum.

The general review of 1941 precipitation might be briefly summarized by stating that the year was outstanding for heavy falls, with the last half of the year especially wet nearly everywhere west of the Mississippi River. The State with the greatest total annual precipitation was Louisiana with 60.57 inches; Nevada, with 13.50 inches, was the driest. It was the wettest year of record in North Dakota, Utah, and New Mexico, with the last State having about a third more precipitation than in any previous year. It was the second wettest year of record in Nevada, Arizona, Texas, Oklahoma, and Kansas. In a limited eastern area, the year was considerably drier than normal, with Tennessee having the driest year of record, and Kentucky, Virginia, and Maryland-Delaware, the second driest.

In the growing season, the period from April 1 to September 30, 1941, the distribution of moisture was quite favorable compared to some recent dry years. No State was more than 23 percent below the normal amount for these 6 months, and the larger crop-producing areas west of the Appalachians were within 20 percent of the normal in the Ohio Valley, and from 4 to 50 percent above normal in the Great Plains. For this portion of the year, the relatively wettest State was New Mexico, with 198 percent of normal, and the relatively driest was New England, with 77 percent.

TABLE 1.—*Monthly and annual temperature departures from normal for the year 1941*

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Alabama	+1.6	−4.8	−5.3	+2.3	+2.1	+.5	+.3	+1.0	+2.5	+7.2	.0	+2.7	+.6
Arizona	+1.4	+2.5	−1.6	−6.1	−.7	−4.0	−1.2	−2.1	−3.0	−3.4	+.3	+.8	−1.4
Arkansas	+2.4	−2.7	−5.1	+2.2	+2.2	−.9	+.7	+.6	+.9	+5.4	−1.3	+1.8	+.5
California	+2.0	+1.7	+1.2	−3.0	+.9	−2.5	−.2	−2.4	−2.4	−2.5	+1.0	+.2	−.5
Colorado	+1.6	+3.4	−.5	−1.4	+3.1	−1.6	−1.6	+.5	−1.2	.0	+1.8	+2.7	+.6
Florida	−1.3	−5.0	−4.8	+.7	−1.2	+.6	.0	+1.9	+1.1	+4.4	+.8	+3.5	+.1
Georgia	+.5	−5.1	−6.1	+2.1	+1.2	+.3	+.4	+1.6	+1.8	+6.4	+.4	+2.4	+.5
Idaho	+3.3	+4.7	+3.9	+.7	+1.1	−.5	+1.2	−.7	−4.3	−1.2	+1.7	+2.6	+1.0
Illinois	+3.2	−1.7	−4.0	+4.8	+4.2	+1.3	+.5	+1.9	+2.4	+3.4	+2.1	+6.4	+2.0
Indiana	+1.8	−2.6	−4.7	+5.2	+3.1	+.9	+.7	+1.2	+3.3	+4.0	+1.7	+5.4	+1.7
Iowa	+5.3	.0	−1.1	+5.1	+5.8	+.4	+.4	+2.9	+2.6	+2.8	+3.7	+7.8	+3.0
Kansas	+3.5	+1.1	−3.0	+1.5	+3.9	−1.7	−.2	+.8	+1.2	+1.1	+1.9	+4.6	+1.2
Kentucky	+.9	−3.9	−5.8	+3.9	+2.3	+.8	−.6	+1.0	+2.5	+5.6	−.4	+4.6	+.9
Louisiana	+1.6	−3.7	−5.8	+1.7	+.3	−.2	+.2	+1.5	+1.7	+6.5	−2.6	+2.2	+.3
Maryland-Delaware	−.9	−1.8	−5.7	+4.6	+1.6	−.2	+.2	−.3	+2.3	+5.8	+2.8	+4.2	+1.0
Michigan	+1.2	+1.5	−3.6	+6.2	+4.3	+2.9	+1.9	+.8	+2.9	+1.7	+2.7	+6.3	+2.4
Minnesota	+4.2	.0	−1.0	+5.7	+5.2	+1.0	+1.7	+1.3	+.8	+1.3	+3.3	+6.9	+2.5
Mississippi	+1.4	−4.1	−5.9	+1.8	+1.6	+.4	+.3	+1.1	+2.2	+6.9	−2.0	+3.0	+.6
Missouri	+4.0	−.4	−3.4	+4.0	+4.4	+.5	+1.2	+2.6	+2.2	+3.9	+1.2	+5.3	+2.1
Montana	+4.7	+5.2	+3.9	+1.1	+2.7	+.9	+2.0	+1.0	−4.1	−1.4	+3.2	+2.5	+1.8
Nebraska	+3.0	+2.0	−1.5	+1.6	+5.4	−.6	+.3	+2.0	+.7	+.7	+3.2	+4.2	+1.8
Nevada	+5.0	+5.7	+2.3	−3.1	+2.0	−2.3	+.1	−2.3	−3.9	−1.9	+.6	+4.0	+.5
New England	−3.2	+1.2	−4.2	+4.9	+1.0	+1.0	+.4	−1.6	+.6	+.2	+2.7	+3.0	+.5
New Jersey	−1.5	−1.3	−4.7	+5.9	+2.2	+.4	.0	−1.0	+1.7	+4.3	+3.1	+3.4	+1.0
New Mexico	+.6	+2.5	−2.3	−3.7	+.2	−3.8	−2.2	−1.0	−1.1	−.6	+1.1	+2.3	−.7
New York	−1.8	+.1	−5.5	+6.0	+1.8	+1.8	+1.8	−1.3	+2.0	+2.2	+4.3	+3.5	+1.2
North Carolina	−.7	−5.4	−5.9	+3.0	+1.7	.0	+.9	+1.0	+2.2	+6.2	+1.2	+2.5	+.6
North Dakota	+4.7	+2.6	+.7	+2.7	+4.6	+1.2	+1.8	+1.6	−1.6	+.6	+3.8	+9.2	+2.7
Ohio	+1.4	−2.1	−5.3	+5.7	+2.8	+1.3	+1.4	.0	+3.2	+4.7	+2.3	+5.5	+1.7
Oklahoma	+3.4	−.2	−4.3	+.9	+2.5	−2.5	−.3	−.3	+.5	+2.1	+.2	+3.9	+.5
Oregon	+3.2	+4.1	+3.5	+.5	+.6	−1.3	+1.7	−1.1	−3.0	−1.0	+2.3	+2.1	+1.0
Pennsylvania	−.5	−1.9	−5.7	+6.4	+1.8	+.5	+.9	−1.5	+1.8	+4.4	+2.8	+4.1	+1.1
South Carolina	−.7	−5.7	−6.2	+2.4	+1.3	.0	+.5	+1.4	+2.2	+6.7	+1.0	+2.3	+.4
South Dakota	+2.8	+2.2	−.2	+2.6	+6.2	+.3	+1.8	+2.9	.0	−.1	+3.6	+6.8	+2.4
Tennessee	+1.0	−4.8	−5.5	+3.4	+2.8	+1.5	+1.7	+2.3	+3.2	+7.1	−.8	+3.5	+1.3
Texas	+2.2	−2.2	−5.8	−.8	+.3	−2.4	−1.0	−.2	+.6	+4.2	−1.3	+2.0	−.4
Utah	+1.9	+3.9	+1.1	−3.6	+1.5	−2.6	−1.1	−1.4	−3.8	−2.0	+.3	+4.0	−.2
Virginia	−.8	−3.6	−5.8	+4.1	+2.0	−.1	+.8	+.4	+2.5	+6.5	+1.9	+3.9	+1.0
Washington	+4.7	+5.1	+5.6	+3.5	+.5	.0	+4.0	.0	−2.4	.0	+2.9	+2.9	+2.2
West Virginia	−.1	−4.1	−7.5	+4.2	+.5	+.4	+1.2	−.6	+1.4	+4.9	+1.1	+4.5	+.5
Wisconsin	+4.0	+.6	−3.8	+6.4	+4.8	+1.5	+1.1	+1.2	+1.9	+1.4	+3.7	+7.4	+2.5
Wyoming	+2.4	+4.2	+.9	−.3	+3.6	−.4	+.6	+.7	−3.0	−1.3	+2.4	+3.5	+1.1

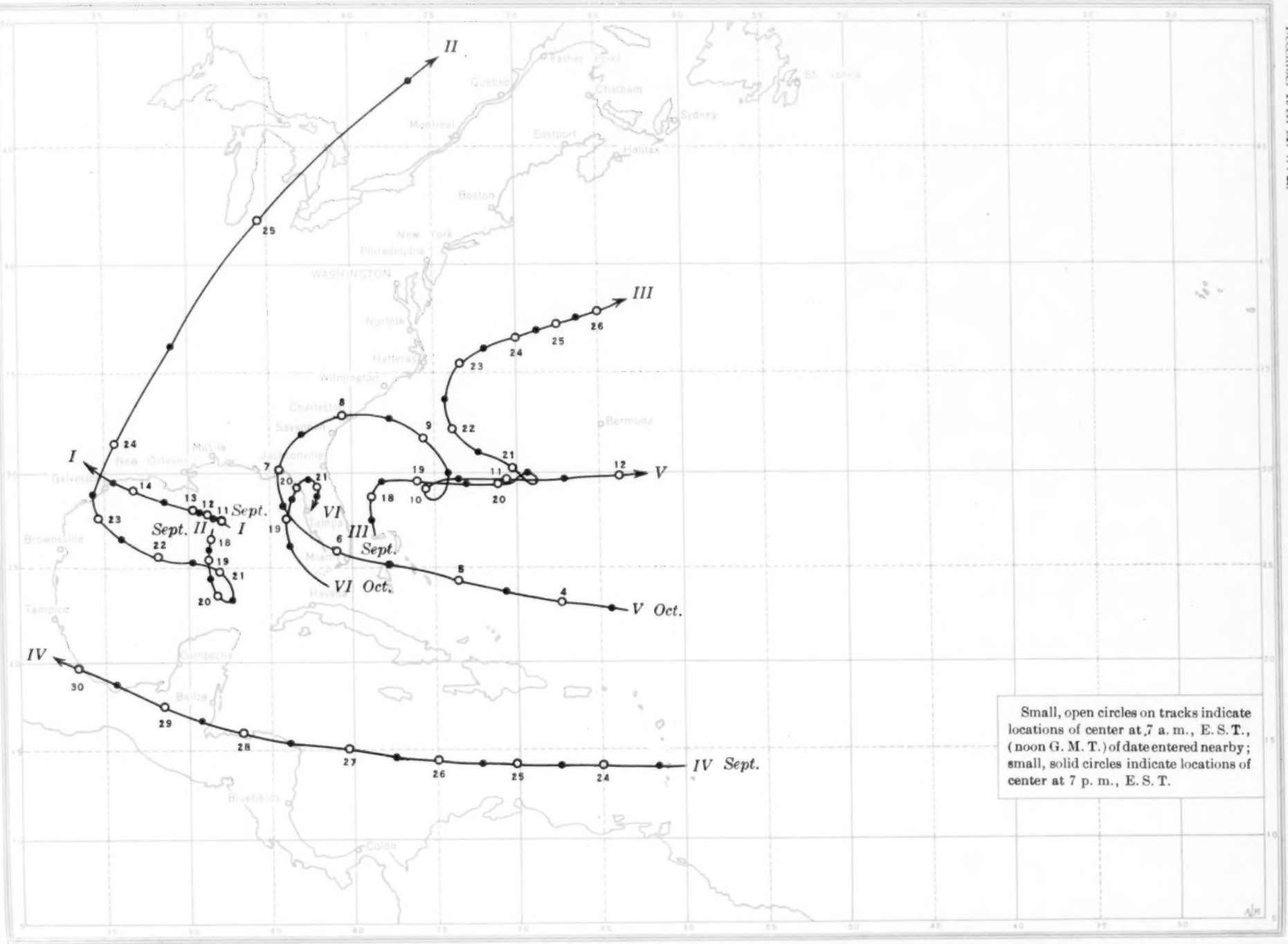
TABLE 2.—*Percentage of normal precipitation, 1941*

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Alabama	56	53	78	68	17	98	147	117	84	77	77	149	87
Arizona	140	164	286	394	224	77	73	94	187	201	114	165	151
Arkansas	80	88	46	103	44	98	128	108	106	259	62	86	96
California	125	173	139	259	123	103	114	230	33	127	79	222	154
Colorado	137	78	152	149	112	156	104	108	225	257	52	97	136
Florida	126	116	121	150	37	114	139	72	92	129	155	145	111
Georgia	45	45	92	57	26	142	126	83	53	87	62	172	86
Idaho	78	72	43	123	181	201	120	283	165	112	95	171	124
Illinois	109	35	39	111	74	106	84	82	137	334	95	75	106
Indiana	54	32	24	77	55	147	76	69	65	252	93	69	83
Iowa	162	46	57	91	80	133	60	55	203	257	106	161	116
Kansas	302	76	62	124	94	159	94	122	169	330	67	128	138
Kentucky	58	19	35	73	30	111	133	84	39	156	81	71	73
Louisiana	73	66	99	72	165	151	131	78	148	204	73	75	109
Maryland-Delaware	94	46	63	83	64	124	124	72	16	57	72	110	79
Michigan	96	79	51	88	87	73	84	129	140	212	115	86	105
Minnesota	123	79	78	150	109	124	67	122	165	165	49	77	116
Mississippi	56	54	82	76	31	86	147	93	91	187	100	92	87
Missouri	154	29	25	116	48	87	73	81	141	353	88	108	105
Montana	49	46	49	123	106	133	96	142	224	93	132	125	115
Nebraska	178	71	71	141	65	129	74	55	190	117	76	147	104
Nevada	93	125	95	223	111	233	203	251	80	296	114	164	154
New England	72	64	71	31	80	101	126	78	43	85	86	98	78
New Jersey	97	68	73	64	50	137	134	85	8	56	91	101	82
New Mexico	205	123	311	217	391	163	107	100	371	270	59	107	195
New York	71	72	75	52	54	88	122	81	62	114	78	102	82
North Carolina	56	47	92	93	27	108	147	72	39	50	52	116	78
North Dakota	115	48	76	158	126	162	70	138	292	125	65	29	134
Ohio	65	29	29	51	70	156	109	99	54	185	69	68	83
Oklahoma	139	179	42	175	101	164	75	121	145	382	66	89	143
Oregon	92	65	36	85	183	243	120	352	151	106	99	158	114
Pennsylvania	81	35	61	58	58	118	119	104	38	85	86	98	80
South Carolina	49	42	116	87	13	177	147	86	36	60	47	191	93
South Dakota	89	46	48	181	59	152	67	81	172	168	34	56	108
Tennessee	55	23	54	82	26	80	168	108	26	130	78	69	74
Texas	91	161	150	148	153	184	136	113	145	237	53	76	141
Utah	101	132	135	241	116	302	142	131	112	316	123	178	163
Virginia	69	35	61	92	29	103	154	62	43	38	52	113	74
Washington	80	52	43	79	185	131	44	274	182	93	81	117	98
West Virginia	75	31	50	62	57	138	118	118	76	104	83	67	84
Wisconsin	118	62	71	89	116	68	76	147	180	189	73	109	112
Wyoming	63	63	85	199	72	168	132	209	146	117	104	134	128

TABLE 3.—*Monthly and annual precipitation (inches), 1941*

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Alabama	2.74	2.78	4.60	2.93	0.66	4.24	7.97	5.29	2.76	2.14	2.51	7.32	45.94
Arizona	1.86	2.17	2.97	2.52	.74	.27	1.64	2.19	2.13	1.55	1.00	1.96	21.00
Arkansas	3.43	2.92	2.21	5.04	2.22	4.01	4.82	3.94	3.57	8.11	2.31	3.67	46.25
California	6.05	7.25	4.99	4.27	1.21	.33	.08	.23	.15	1.56	1.95	8.15	36.22
Colorado	1.04	.76	1.98	2.67	2.13	2.19	2.31	2.12	2.97	3.01	.42	.87	22.47
Florida	3.44	3.55	3.74	4.30	1.48	7.62	10.02	5.10	6.22	5.46	3.40	4.01	58.34
Georgia	1.85	2.18	4.48	2.06	.90	6.27	7.18	4.29	1.96	2.32	1.68	7.28	42.45
Idaho	1.62	1.20	.74	1.68	2.98	2.43	.73	1.70	1.63	1.55	1.93	3.37	21.56
Illinois	2.50	.75	1.19	3.75	3.09	4.34	2.75	2.74	4.96	9.14	2.63	1.68	39.52
Indiana	1.66	.76	.92	2.68	2.24	5.64	2.54	2.33	2.22	6.86	2.84	1.98	32.67
Iowa	1.73	.50	.99	2.50	3.26	6.20	2.24	1.94	7.73	6.11	1.71	1.92	36.83
Kansas	1.99	.77	.90	3.22	3.54	6.35	3.05	3.86	4.76	6.51	.88	1.09	36.92
Kentucky	2.53	.66	1.65	2.89	1.20	4.67	5.51	3.13	1.16	4.25	2.80	2.80	33.25
Louisiana	3.54	3.05	4.72	3.34	7.61	7.01	8.04	3.96	5.80	6.63	2.83	4.04	60.57
Maryland-Delaware	3.05	1.41	2.17	2.98	2.19	4.88	5.27	3.11	.53	1.64	1.84	3.48	32.55
Michigan	1.80	1.32	1.10	2.27	2.77	2.29	2.38	3.41	4.52	5.80	2.84	1.78	32.28
Minnesota	.92	.58	.93	3.08	3.45	5.05	2.24	3.88	4.76	3.23	.57	.61	29.30
Mississippi	2.79	2.66	4.77	3.67	1.39	3.59	7.38	3.97	2.82	4.92	3.62	4.88	46.46
Missouri	3.41	.58	.78	4.50	2.30	4.23	2.75	3.15	5.83	10.14	2.29	2.21	42.17
Montana	.46	.35	.49	1.37	2.24	3.29	1.33	1.53	2.98	1.00	1.33	1.21	17.58
Nebraska	.98	.51	.78	3.46	2.28	4.86	2.47	1.55	4.06	1.88	.59	1.03	24.45
Nevada	1.10	1.28	.93	1.74	.98	1.14	.73	1.28	.33	1.66	.74	1.59	13.50
New England	2.47	2.02	2.34	1.04	2.66	3.42	4.70	3.02	1.62	2.99	2.96	3.21	32.45
New Jersey	3.47	2.47	2.76	2.32	1.86	5.09	6.40	4.06	.28	1.90	2.90	3.70	37.21
New Mexico	1.15	.87	2.33	1.93	4.50	2.02	2.75	2.49	5.97	3.10	.39	.74	28.24
New York	2.08	1.94	2.28	1.55	1.87	3.22	4.81	3.03	2.13	3.75	2.37	2.95	31.98
North Carolina	2.04	1.90	3.88	3.26	1.14	5.05	8.56	3.96	1.56	1.67	1.36	4.42	38.80
North Dakota	.54	.22	.58	2.30	2.94	5.54	1.76	2.86	4.61	1.32	.40	.15	23.22
Ohio	1.97	.76	.97	1.60	2.60	5.91	4.15	3.35	1.61	4.73	1.89	1.89	31.43
Oklahoma	2.03	2.42	.92	5.94	4.79	6.30	2.24	3.62	4.44	11.47	1.36	1.51	47.04
Oregon	3.52	2.00	.98	1.69	3.19	2.94	.54	1.48	1.83	2.03	3.71	5.99	29.90
Pennsylvania	2.62	1.04	2.10	2.01	2.25	4.96	5.11	4.37	1.33	2.76	2.46	3.09	34.10
South Carolina	1.74	1.81	4.52	2.65	.46	8.42	8.54	4.88	1.49	1.83	1.08	6.95	44.37
South Dakota	.49	.26	.54	3.90	1.77	5.35	1.75	1.85	2.87	2.17	.23	.32	21.50
Tennessee	2.60	1.02	2.90	3.62	1.06	3.39	7.43	4.34	.79	3.68	2.79	3.15	36.77
Texas	1.75	3.00	3.16	4.57	5.65	5.72	3.56	2.74	4.25	6.21	1.20	1.72	43.53
Utah	1.20	1.62	1.88	2.87	1.41	1.69	1.25	1.38	1.12	3.32	1.17	1.91	20.82
Virginia	2.20	1.09	2.26	3.05	1.09	4.27	6.93	2.69	1.36	1.12	1.27	3.47	30.80
Washington	3.96	1.93	1.43	1.87	3.69	2.07	.29	2.08	3.32	2.74	4.21	6.39	33.98
West Virginia	2.73	.96	1.95	2.17	2.28	6.03	5.39	4.80	2.22	2.89	2.31	2.24	35.97
Wisconsin	1.41	.72	1.25	2.27	4.19	2.74	2.72	4.70	6.57	4.67	1.36	1.41	34.01
Wyoming	.49	.48	.99	3.17	1.53	2.68	1.72	2.30	1.67	1.28	.73	.99	18.03

Paths of Hurricanes and Other Tropical Storms of 1941


II
III
I
V
VI
III Sept.
I Sept.
II Sept.
VI Oct.
V Oct.
IV
IV Sept.
Small, open circles on tracks indicate locations of center at 7 a. m., E. S. T., (noon G. M. T.) of date entered nearby; small, solid circles indicate locations of center at 7 p. m., E. S. T.

NORTH ATLANTIC TROPICAL DISTURBANCES OF 1941

By HOWARD C. SUMNER

[Weather Bureau, Washington, January 1942]

The hurricane season of 1941, near normal in other respects, was of exceptionally short duration. During the 37 days between the 11th of September and the 18th of October, 6 tropical disturbances developed in rapid succession, an average of approximately 1 storm every 6 days. The 21 disturbances of 1933, the highest number ever recorded in a single season during the 55-year period of record, had an average of about 8.5 days between storms.

The first and last storms of the past season were of slight intensity with only minor damage being reported. The remaining disturbances all developed winds of full hurricane force. They took a combined toll of over 60 lives, and wrought crop and property losses estimated at well over $10,000,000. An unusual situation developed September 23 when 3 hurricanes (II, III, and IV on the accompanying chart) were in progress simultaneously at widely separated points, one in the eastern Caribbean, one in the Gulf of Mexico, and another in the North Atlantic off Hatteras.

The only disturbance associated with the Caribbean Sea area traversed the entire length of that body of water from east to west, maintaining hurricane winds for almost the entire distance. It then moved across the coast of Nicaragua and emerged into the Gulf of Honduras with undiminished intensity. After crossing additional countries of Central America and the Bay of Campeche it moved inland, for the third time, and dissipated south of Tampico, Mexico. Of the remaining disturbances, two crossed the Texas coast, two moved inland in Florida, and one spent its energy over the North Atlantic, with no destructive winds being reported on land.

Two-thirds of these disturbances developed winds of hurricane force. This proportion, though considerably above normal, is not unusual when all or most of the disturbances develop during a short period at the height of the hurricane season.

A synopsis of the tropical disturbances of 1941 is given in the following table. Their tracks, numbered I to VI chronologically, are shown on the accompanying chart.

NORTH ATLANTIC TROPICAL DISTURBANCES OF 1941

[Synopsis of tropical disturbances of 1941 (number of storm in table corresponds to number of track on accompanying chart)]

Storm	Date	Place where first reported	Coast lines crossed	Maximum wind velocity reported	Lowest barometer reported	Place of dissipation	Intensity	Remarks
I	Sept. 11–15	About 120 miles southeast of Port Eads, La.	Texas	Force 8 ENE, a ship.	1002.7 millibars (29.61 inches), a ship.	East Texas coast	Not of hurricane intensity.	No property damage or injuries reported (A).
II	Sept. 18–26	About 180 miles south of Port Eads, La.	do	Force 12 NE., a ship, 83 miles per hour, Texas City, Tex.	970.5 millibars (28.66 inches), a ship.	Southern Quebec Province.	Full hurricane	4 lives lost; $2,000,000 property damage; crop losses estimated in excess of $5,000,000 (A).
III	Sept. 18–26	Off east central Florida coast.	None	Force 12 ESE, a ship.	995.3 millibars (29.39 inches), a ship.	Near 38° N., 63° W	do	Caused considerable delay in North Atlantic shipping (A).
IV	Sept. 23–30[1]	Between Barbados and St. Lucia.	Nicaragua, British Honduras, and Mexico.	100 miles per hour (estimated), a ship.	992.9 millibars (29.32 inches), a ship.	Eastern Mexico	do	47 lives lost at sea; 3 drowned at Cape Gracias; heavy crop and property damage in Central America (A).
V	Oct. 3–12	About 300 miles north of Virgin Islands.	Florida	123 miles per hour, Pan-American Dinner Key base.	964.4 millibars (28.48 inches), Cat Island.	South of Bermuda	do	8 lives lost in the Bahamas and Florida; considerable property and crop damage in Florida, Georgia and the Bahamas (B).
VI	Oct. 18–21[2]	About 100 miles off the west Florida coast.	do	45 miles per hour WSW, a ship.	1002.4 millibars (29.60 inches), a ship.	North Florida	Not of hurricane intensity.	Torrential rains wrought some flood damage in northern Florida (B).

[1] A late special report received from Mr. Albert Krog, Radio Operator of the Standard Fruit & Steamship Co., Puerto Cabezas, Nicaragua, states that on September 27, about 20 miles up the Río Coco from Cape Gracias, the barometer on the schooner *Bravo* fell to 28.25 inches (uncorrected), at about 3 p. m. Farther inland from the Cape, at Boom, the central calm of the hurricane lasted from 5 to 6 p. m.

[2] Squally weather had moved across the southern Bahamas and through the Florida Straits during the preceding 2 days, but no definite cyclonic circulation could be detected until the evening of Oct. 18.

Complete reports of these disturbances may be found in the MONTHLY WEATHER REVIEW: (A) September 1941; 69: 264–266. (B) October 1941; 69: 303, 304.

TYPHOONS AND DEPRESSIONS OVER THE FAR EAST, OCTOBER 1941

By BERNARD F. DOUCETTE, S. J.

[Weather Bureau, Manila, P. I.]

Depression, October 18–23, 1941.—About half way between Yap and Mindanao a low-pressure area became a depression moving in a west-northwesterly direction, October 18 and 19. The afternoon and evening observations from stations near San Bernardino Strait indicated that the storm was intensifying, yet the morning of October 20 showed only a depression, central over Bondoc Peninsula, which had moved westerly across southern Luzon during the night. This weak center moved westerly into the China Sea. As a depression of minor importance, it moved northwest about 200 miles after leaving Verde Island Passage, then westerly to Indo-China where it disappeared.

Two lives were lost on Marinduque Island as this depression crossed the Archipelago. Considerable rain was reported from stations of southern Luzon and the Visayan Islands.

As this center was approaching southern Luzon, October 19, Virac, Catanduanes Island reported 751.2 mm. (1000.5 mb.) indicating that the storm was intensifying to typhoon strength. However, during the night, nothing lower than the above value was reported as the storm center moved across the Archipelago.

The upper winds over Zamboanga and Cebu changed from the east quadrant to the southwest quadrant on

October 16. Almost at the same time, a mild surge from the east quadrant appeared over Guam. As the depression center came into existence, Zamboanga and Cebu velocities were weak, but directions showed a tendency to shift to the northwest quadrant. This tendency also appeared in the directions of the lower clouds over stations of the Visayan Islands. Because of these weak velocities and the movement of cool air from northern regions around the regions south of the center into the weak southwesterly air stream, there was no development. Velocities of the upper winds over Cebu and Zamboanga reached values of 50 and 60 k. p. h. only on October 20, when the depression center was moving toward Verde Island Passage. Other days, values were below 40 k. p. h. Indications that the southwesterly air stream was weak over southern Indo-China and Thailand were shown by the scattered reports received from these regions.

Typhoon, October 22–November 2, 1941.—As well as can be determined from available data, this typhoon seems to have formed far to the southeast or south-southeast of Guam. On October 22, a definite center, quite intense, seemed to be located about 300 miles south-southeast of Guam, and its movement was in a north-northwesterly direction. From October 23 to 25, this typhoon moved northerly along a course about 120 miles east of Guam. The next 3 days, the center seemed to be close to and east of the northern Mariana Islands, stationary perhaps, or moving slowly in various directions. October 28 to 31, it moved west-northwest to the ocean regions about 300 miles southwest of the Bonin Islands. It either disappeared over those regions or moved about 500 miles to the east as a low pressure area (October 31 to November 2) after which no trace of the storm could be found.

The upper winds over Guam from October 17 onward were from the northeast and east quadrants, the velocities never exceeding 47 k. p. h. and mostly between 5 and 30 k. p. h. On October 21, the winds were backing to the north-northeast, velocities being less than 40 k. p. h. On October 22 and the 2 following days, the directions were from the north-northwest and north, with velocities ranging from 15 to 67 k. p. h. On October 25 and the following days, Guam was under the influence of air streams from the west and southwest quadrants, with velocities less than 40 k. p. h. Stations over the Philippines were reporting directions from the northeast, east, and southeast quadrants during these days, with no evidence that the southwest monsoon air stream was present over the Archipelago.

After October 19, no ships' observations were on hand. The above account of the origin and course of the typhoon, especially after October 24, may have to be altered when such observations from ships become available later.

METEOROLOGICAL AND CLIMATOLOGICAL DATA FOR DECEMBER 1941

[Climate and Crop Weather Division, J. B. KINCER in charge]

AEROLOGICAL OBSERVATIONS

By HOMER D. DYCK

Mean surface temperatures for December, as for the preceding months of the year, were above normal in practically all sections of the country. Nearly all sections reported means 2° to 10° F. above normal; the extreme Northeast, the Southern States and Pacific coast districts had the smallest plus departures, mostly 2° or 3° F., and the area from the Ohio and central Mississippi Valleys and southern Great Plains northward the largest, generally 5° to 11° F.

At 1,500 meters above sea level the 5 a. m. resultant winds for December were from directions to south of normal over most of the country with the exception of southern Texas, the north Pacific coast and several scattered stations where they were to north of normal. At 3,000 meters the morning resultant winds were to south of normal over practically all stations where a comparison was possible. These stations were located in the Rocky Mountain and Plateau regions, the central and northern Great Plains, the central Mississippi Valley, and the central Gulf States. At 5,000 meters a comparison of the afternoon resultants with the a. m. normals was possible only over the Rocky Mountain region, Oklahoma and Texas, and all resultants in these regions were to south of normal. It was in accordance with the tendency of resultant wind directions to turn to southward in most parts of the country that surface temperatures were above normal.

At 1,500 meters resultant wind velocities were below normal over the extreme northern Plateau and extreme northern Rocky Mountain region, the Southeast and the North and Middle Atlantic States, while they were above normal generally elsewhere. At 3,000 meters a comparison of December a. m. resultant velocities was not possible over the Pacific States, the Lake region and Texas. Velocities were below normal, however, over the northern Great Plains, Oklahoma and northern New Mexico, and generally above normal elsewhere. At 5,000 meters the 9 stations where a comparison was possible showed December a. m. velocities above the p. m. normals.

When the 5 p. m. resultant directions are compared to the 5 a. m. resultant directions, no well-marked pattern of change is evident; and the number of stations where there was turning to southward during the day about equaled the number where the opposite shift took place at both 3,000 and 5,000 meters.

The 5 p. m. resultant velocities were lower than the 5 a. m. resultant velocities over the far Northwest, the Lake region, the middle Mississippi and Ohio Valleys and the central Gulf States and higher than the morning winds elsewhere. At 3,000 meters a comparison of a. m. and p. m. resultant velocities was not possible over the Pacfiic States, the Lake region and the Northeast. Afternoon velocities were lower than morning velocities, however, over the central Rocky Mountain region and the Southeast and generally higher elsewhere.

The upper air data discussed above are based on 5 a. m. (E. S. T.) pilot balloon observations (charts VIII and IX) as well as on observations made at 5 p. m. (table 2 and charts X and XI).

The highest mean monthly pressure was recorded at Miami, Fla., at all standard levels from 2,000 to 16,000 meters inclusive. Brownsville, Tex., also recorded the maximum at 16,000 meters. The lowest mean monthly pressure from 2,000 to 4,000 meters inclusive was recorded over Sault Ste. Marie, at 5,000 meters over Seattle, and at 6,000 meters over both Sault Ste. Marie and Seattle. From 7,000 to 14,000 meters the lowest mean monthly pressure was recorded over Seattle. At 13,000 meters the lowest mean was also recorded over Spokane while at 14,000 meters a number of stations, namely, Bismarck, Great Falls, Portland, Me., Sault Ste. Marie, Seattle and Spokane recorded the minimum. At 15,000 and 16,000 meters the lowest mean monthly pressure was recorded over Portland, Maine.

Except for a few small exceptions, mean monthly pressures were lower this month than last over the United States at all levels from the surface to 19,000 meters. Surface pressures were slightly higher than last month over the Lake Region, the Northeast and Florida. Decreases were considerable over the far Northwest amounting to as much as 12 millibars at Seattle from 5,000 to 7,000 meters. Pressure gradients were steeper in December than in November over the West and the South and about the same elsewhere. The steepest upper level pressure gradient for December occurred between Sault Ste. Marie and Detroit at levels from 6,000 to 9,000 meters inclusive, where there was a change of 1 millibar pressure for each 38 miles of horizontal distance between the two stations.

The mean temperatures for December were considerably lower than in November for nearly all stations from the surface to about 12,000 meters. Above this level to about 17,000 meters temperatures were generally higher over the western half of the country and the Northeast and generally lower elsewhere.

Mean temperatures for December 1941 were generally lower than those for December 1940 at levels up to about 10,000 meters over the western half of the country and the Northeast and higher over the remainder of the country. From 10,000 to about 17,000 meters temperatures tended to be higher than in December 1940 except over the Gulf States where they were slightly lower.

Temperatures for December at 1,000, 3,000 and 5,000 meters were generally below normal west of the Rocky Mountains and the extreme Northeast and above normal elsewhere.

Except for a few scattered exceptions, relative humidities for December were generally above normal at 1,000 meters. At the 3,000 and 5,000 meter levels humidities were generally above normal over the Northwest and the Lake region, and the extreme Northeast and generally below normal elsewhere.

The mean surface temperature for the month of December as recorded by radiosonde observations (table 1) was 0° or lower at all stations in the Northeast, the upper Lake region, the extreme northern Great Plains, the extreme northern Rocky Mountain region and extreme northern Plateau region. The surface temperature at Ely, Nev., was also below 0° C. At Lakehurst, N. J., where the surface temperature averaged 0° C., an inversion occurred above the surface where the temperature was above 0° C. Over the rest of the United States the altitude at which a mean temperature of 0° C. occurred varied from the lowest (500 meters) over Buffalo, N. Y., to the highest (4,300 meters) over Miami, Fla. This level was much lower this month than last over the Plateau region, being 1,600 meters lower over Boise, Idaho.

The lowest free-air temperature recorded during the month over the United States was −82.7° C. (−116.9° F.) This temperature occurred over Brownsville, Tex., on December 5th at an altitude of 16,400 meters (about 10 miles) above sea level. The lowest temperature for the month over San Juan was −84.1° C. (−119.4° F.) observed at 18,200 meters (about 11.3 miles) above sea level on December 16th.

Table 3 shows the maximum free-air wind velocities for various sections of the United States during December as determined by pilot balloon observations. The highest observed wind velocity for the month was 84.0 m. p. s. (188 miles per hour) observed over Oklahoma City, Okla. on December 5. This wind was blowing from the west-southwest at an elevation of 9,970 meters (about 6.2 miles) above sea level.

The highest December wind velocity observed during the last 5 years in the free-air layer from the surface to 2,500 meters was 56.6 m. p. s. (127 miles per hour) observed blowing from the west on December 31, 1939 over Richmond, Va., at an altitude of 2,480 meters (about 1.5 miles). The highest observed wind velocity in the last 5 years for the free-air layer between 2,500 and 5,000 meters was 65.8 m. p. s. (147 miles per hour) observed blowing from north-northwest on December 27, 1940 over Abilene, Tex., at an altitude of 4,390 meters (about 2.7 miles). A still higher wind velocity, 92.2 m. p. s. (206 miles per hour) was observed during the same 5 year period in the layer above 5,000 meters. This wind was blowing from the northwest at an elevation of 8,910 meters (about 5.5 miles) over Casper, Wyo., on December 28, 1940.

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during December 1941*

[Stations with elevations in meters above sea level]

Altitude (meters), m. s. l.	Albuquerque, N. Mex. (1,620 m.)				Atlanta, Ga. (300 m.)				Bismarck, N. Dak. (505 m.)				Boise, Idaho (864 m.)				Brownsville, Tex. (6 m.)				Buffalo, N. Y. (221 m.)				Charleston, S. C. (14 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	837	3.1	55	31	984	7.2	76	31	955	−5.3	77	28	915	1.1	82	31	1,017	16.1	92	31	991	0.6	80	31	1,018	9.5	89
500					31	961	9.0	66									31	959	16.1	85	31	957	−.1	81	31	961	11.3	72
1,000					31	905	9.1	58	31	897	−2.6	68	28	900	1.9	79	31	905	14.2	76	31	899	−2.1	80	31	905	10.3	63
1,500					31	852	8.0	51	31	842	−3.1	62	28	846	.1	76	31	853	12.9	63	31	844	−3.4	76	31	852	8.6	55
2,000	31	799	3.5	54	31	802	7.1	43	31	790	−4.7	59	28	794	−2.5	73	31	803	11.5	58	31	792	−4.5	72	31	802	6.8	50
2,500	31	751	1.2	54	31	754	5.1	41	31	741	−7.2	57	28	746	−5.5	74	31	757	9.8	54	31	743	−6.3	67	31	754	5.3	43
3,000	31	706	−1.6	53	29	709	2.8	38	31	695	−9.5	56	28	699	−8.2	73	31	712	7.1	50	31	697	−8.2	63	30	709	2.9	42
4,000	31	622	−6.3	49	28	626	−3.0	36	31	610	−14.6	56	27	614	−14.3	71	31	630	1.5	45	30	612	−13.3	55	30	626	−2.7	40
5,000	31	546	−12.2	47	26	551	−9.1	34	31	534	−20.6	54	27	538	−20.2	70	31	556	−4.8	43	30	536	−19.3	52	30	551	−9.1	41
6,000	30	478	−19.1	43	25	484	−15.6	33	31	466	−27.3	54	27	469	−26.9	66	29	489	−11.7	44	30	468	−26.0	50	30	484	−16.0	42
7,000	30	417	−26.6	42	24	423	−22.3	33	31	404	−34.5	54	27	407	−34.2	63	28	428	−18.4	43	29	407	−33.4	48	30	423	−22.8	43
8,000	29	363	−34.0	42	24	368	−29.2	32	31	349	−41.9	----	27	352	−41.7	----	28	374	−25.4	40	27	352	−40.7	----	29	368	−29.9	47
9,000	29	314	−40.8	----	24	320	−36.5	31	31	300	−48.6	----	27	303	−48.0	----	27	324	−32.7	39	25	304	−47.1	----	28	319	−37.1	44
10,000	28	271	−46.4	----	24	276	−43.0	----	30	258	−53.4	----	27	260	−52.9	----	26	282	−40.4	----	24	261	−51.8	----	28	275	−44.7	----
11,000	27	232	−50.2	----	24	238	−49.7	----	29	221	−55.7	----	27	223	−55.0	----	23	242	−48.0	----	22	224	−54.9	----	28	237	−51.9	----
12,000	27	199	−53.6	----	23	204	−55.5	----	27	188	−55.7	----	23	191	−55.4	----	22	208	−55.2	----	20	191	−55.9	----	28	202	−58.1	----
13,000	26	170	−56.6	----	22	174	−60.0	----	26	161	−55.1	----	21	163	−54.9	----	19	177	−61.0	----	18	164	−57.8	----	26	172	−62.5	----
14,000	25	145	−58.1	----	21	148	−62.2	----	22	137	−54.9	----	17	139	−55.0	----	16	151	−65.6	----	13	140	−59.3	----	24	146	−64.8	----
15,000	23	124	−59.8	----	20	126	−64.6	----	15	117	−55.6	----	14	118	−56.1	----	15	128	−70.5	----	11	118	−61.1	----	22	124	−68.0	----
16,000	21	106	−61.6	----	19	107	−66.2	----	10	101	−55.7	----	11	101	−56.7	----	12	108	−73.6	----	9	101	−61.1	----	19	105	−70.5	----
17,000	18	90	−62.6	----	13	90	−67.7	----	----	----	----	----	5	86	−56.8	----	6	91	−76.6	----	7	86	−61.1	----	15	89	−70.2	----
18,000	11	77	−63.1	----	5	76	−67.7	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	8	75	−69.6	----

See footnotes at end of table.

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during December 1941*—Continued

Altitude (meters) m. s. l.	Denver, Colo. (1,616 m.)				Detroit, Mich. (194 m.)				El Paso, Tex.(1,193 m.)				Ely, Nev. (1,908 m.)				Great Falls, Mont. (1,128 m.)				Huntington, W. Va. (172 m.)				Joliet, Ill. (178 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	834	−3.0	65	31	993	0.9	84	31	882	6.8	57	31	806	−3.2	84	30	884	−3.0	68	31	999	3.5	83	30	995	0.8	89
500					31	956	.3	81													31	960	4.5	75	30	957	1.0	86
1,000					31	898	−1.3	77													31	902	2.8	71	30	899	−.1	82
1,500					31	843	−1.7	66	31	850	9.0	47					30	843	−3.3	68	31	848	1.1	68	29	844	−1.1	79
2,000	31	796	1.4	58	31	792	−3.0	60	31	800	6.5	43	31	797	−2.2	81	30	791	−5.6	68	31	797	.1	60	29	792	−2.1	72
2,500	31	748	−.3	54	31	743	−4.7	54	31	753	4.1	38	31	748	−3.5	76	30	742	−7.7	67	31	748	−1.6	55	29	744	−3.9	66
3,000	31	702	−3.1	52	31	697	−6.5	50	31	708	1.5	36	31	702	−6.0	74	30	695	−9.9	66	31	703	−3.7	51	29	698	−6.1	63
4,000	31	618	−9.2	50	29	613	−11.1	43	31	624	−4.0	33	31	617	−10.9	71	30	610	−15.5	64	31	618	−9.0	49	29	614	−11.0	57
5,000	30	542	−15.6	48	29	538	−17.2	40	30	549	−10.5	31	31	542	−17.3	65	30	534	−22.1	64	30	543	−14.9	46	29	538	−17.4	54
6,000	30	474	−22.8	46	29	470	−23.6	38	29	481	−17.7	30	31	473	−24.8	60	30	465	−28.8	63	30	475	−21.9	44	29	470	−24.4	54
7,000	30	413	−30.4	46	28	408	−30.6	37	28	420	−24.1	28	31	411	−32.5	58	30	403	−36.5	63	30	413	−28.4	40	29	409	−31.4	53
8,000	30	358	−38.1	46	27	354	−37.4	36	28	366	−30.8	27	30	356	−39.5	56	29	348	−44.1	----	29	359	−35.0	39	29	354	−38.2	52
9,000	29	309	−45.1	----	26	306	−44.2	----	27	317	−37.8	27	28	307	−45.9	----	29	299	−50.7	----	26	310	−42.4	----	27	306	−44.6	----
10,000	28	265	−50.4	----	26	263	−49.1	----	27	274	−44.4	----	27	263	−51.2	----	28	257	−54.8	----	25	267	−48.1	----	26	263	−49.6	----
11,000	28	227	−54.2	----	26	226	−52.8	----	27	235	−50.2	----	25	226	−54.6	----	28	220	−56.4	----	20	229	−53.2	----	26	225	−52.9	----
12,000	26	194	−55.8	----	25	193	−53.9	----	26	201	−54.5	----	24	192	−56.3	----	28	188	−56.0	----	20	196	−55.9	----	25	193	−55.1	----
13,000	25	166	−56.5	----	24	165	−55.0	----	25	172	−57.4	----	22	164	−56.6	----	25	160	−55.4	----	17	167	−57.0	----	23	164	−56.2	----
14,000	23	142	−57.1	----	20	141	−56.4	----	25	147	−60.7	----	20	140	−57.2	----	19	137	−55.5	----	14	143	−59.2	----	23	140	−57.3	----
15,000	23	121	−57.9	----	17	120	−57.5	----	25	124	−63.1	----	19	119	−59.1	----	16	117	−56.1	----	10	121	−61.2	----	22	120	−58.3	----
16,000	19	103	−58.9	----	15	102	−58.3	----	21	105	−65.8	----	11	102	−60.5	----	7	100	−56.9	----	8	103	−62.4	----	20	102	−59.2	----
17,000	12	88	−59.9	----	10	87	−58.4	----	17	90	−67.3	----	6	86	−60.5	----									13	87	−59.8	----
18,000					6	74	−58.6	----	10	76	−67.8	----													9	74	−59.7	----
19,000									5	64	−67.3	----													6	64	−59.1	----

Altitude (meters), m. s. l.	Lake Charles, La. (5 m.)				Lakehurst, N. J.[1] (39 m.)				Medford, Oreg. (401 m.)				Miami, Fla. (4 m.)				Nashville, Tenn. (180 m.)				Norfolk, Va.[1 2] (10 m.)				Oakland, Calif. (2 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	1,018	11.6	84	25	1,014	0.0	76	31	966	4.2	89	31	1,018	19.7	90	31	998	6.4	78	22	1,021	5.1	77	30	1,016	10.9	81
500	31	960	11.9	72	25	958	.1	65	31	954	4.2	88	31	961	19.2	84	31	960	6.1	75	22	960	4.8	66	30	957	9.6	77
1,000	31	904	10.2	64	25	900	−.6	59	31	897	3.2	82	31	907	16.6	80	31	903	4.5	73	22	903	3.1	60	30	901	7.2	74
1,500	31	852	9.1	57	25	845	−1.5	54	31	843	1.0	80	31	855	14.2	74	31	849	3.7	64	22	849	3.0	50	30	848	4.8	72
2,000	31	801	8.2	51	25	794	−2.5	51	31	792	−1.9	79	31	806	12.3	64	31	798	2.4	57	22	798	2.5	43	30	797	2.3	69
2,500	31	754	6.4	49	25	745	−4.3	47	31	744	−4.7	76	31	759	10.2	56	31	750	1.1	52	21	750	0.6	39	30	749	−.4	64
3,000	31	709	4.2	44	25	699	−6.5	46	31	697	−7.7	69	31	714	7.5	53	30	705	−1.0	49	21	704	−1.4	35	30	704	−3.5	60
4,000	31	626	−1.2	40	25	614	−11.5	44	29	612	−13.7	65	30	632	2.1	50	28	621	−6.2	41	20	620	−7.1	33	30	619	−8.9	54
5,000	31	552	−7.5	40	25	538	−17.5	38	29	536	−19.9	60	30	558	−4.1	48	27	546	−12.5	39	17	544	−14.2	33	30	544	−15.0	49
6,000	31	484	−14.7	40	25	470	−24.4	32	29	468	−26.6	56	30	491	−10.1	46	25	478	−18.8	34					30	476	−21.6	49
7,000	29	424	−22.0	40	25	409	−31.7	34	29	406	−34.0	52	30	430	−16.9	43	20	417	−25.5	35					29	414	−28.6	50
8,000	29	369	−29.2	40	25	354	−38.5	----	29	351	−41.3	----	29	376	−24.0	42	18	362	−32.6	37					28	360	−35.5	49
9,000	29	320	−36.4	40	25	305	−44.4	----	29	302	−47.6	----	29	327	−31.4	41	17	313	−39.9	----					28	311	−42.5	----
10,000	29	277	−43.2	----	25	263	−50.1	----	28	260	−52.8	----	29	284	−39.0	41	16	270	−46.7	----					26	268	−48.5	----
11,000	27	238	−49.9	----	24	226	−54.5	----	28	223	−55.8	----	29	244	−46.8	----	14	232	−52.9	----					24	230	−53.2	----
12,000	26	203	−56.0	----	24	193	−56.3	----	27	190	−56.7	----	29	210	−54.3	----	14	198	−57.3	----					23	197	−55.6	----
13,000	25	173	−60.7	----	21	166	−56.9	----	24	162	−56.6	----	29	179	−61.3	----	12	169	−60.1	----					23	168	−56.1	----
14,000	25	147	−64.2	----	19	141	−58.2	----	21	138	−56.8	----	29	152	−67.2	----	12	144	−63.4	----					21	143	−56.6	----
15,000	24	125	−67.7	----	14	120	−59.4	----	19	118	−57.8	----	29	128	−71.2	----	11	122	−66.1	----					18	122	−57.6	----
16,000	21	106	−70.2	----	11	102	−60.7	----	14	100	−57.8	----	27	108	−73.8	----	10	103	−67.5	----					15	104	−59.5	----
17,000	16	89	−71.1	----	6	86	−61.7	----	7	87	−58.2	----	19	91	−75.6	----	7	87	−66.7	----					11	88	−60.5	----
18,000	5	75	−69.5	----									13	77	−75.9	----									5	74	−60.6	----
19,000													6	64	−75.0	----												

Altitude (meters), m. l. s.	Oklahoma City, Okla. (391 m.)				Omaha, Nebr. (301 m.)				Pensacola, Fla.[1] (24 m.)				Phoenix, Ariz. (339 m.)				Portland, Maine (20 m.)				St. Louis, Mo. (171 m.)				St. Paul, Minn. (225 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	972	4.9	80	31	981	−0.6	81	23	1,018	13.2	74	31	975	9.7	75	29	1,014	−2.8	73	30	998	3.2	79	31	989	−2.9	84
500	31	959	5.9	74	31	957	.4	73	23	962	12.0	59	31	957	13.3	54	29	955	−3.0	71	30	958	3.6	75	31	956	−3.5	83
1,000	31	902	5.6	63	31	899	.7	63	23	906	10.6	52	31	902	12.0	46	29	896	−4.6	69	30	901	2.3	73	31	897	−3.1	76
1,500	31	849	4.9	56	31	845	.6	55	23	854	10.1	45	31	849	9.2	45	29	841	−5.7	67	29	847	1.8	66	31	842	−3.3	68
2,000	31	798	3.6	48	31	793	−1.1	52	23	804	9.3	39	31	799	6.1	45	29	788	−6.9	62	29	796	.7	58	31	790	−3.6	59
2,500	31	750	1.9	40	31	745	−2.7	50	23	756	6.8	37	31	752	3.1	44	29	739	−8.4	60	29	747	−1.1	54	31	742	−5.4	54
3,000	31	705	−.1	34	31	699	−4.6	48	23	711	4.0	35	31	706	.4	40	29	693	−10.7	58	29	702	−3.1	51	31	696	−7.5	49
4,000	31	621	−6.0	33	31	615	−10.3	46	22	628	−2.1	37	29	623	−5.1	37	29	608	−16.0	55	29	618	−8.7	46	31	611	−12.9	49
5,000	29	546	−12.3	30	31	539	−16.7	42	22	554	−8.2	40	28	548	−11.5	37	29	532	−22.2	54	29	543	−15.5	43	30	535	−18.9	47
6,000	29	479	−19.1	29	30	472	−23.4	40	21	486	−14.8	41	28	480	−18.6	36	29	463	−28.4	52	28	474	−22.2	40	29	467	−25.9	46
7,000	28	418	−26.4	29	29	410	−30.9	38	20	425	−21.5	46	27	419	−25.8	34	29	402	−34.8	49	27	414	−28.6	39	29	406	−33.1	45
8,000	28	363	−33.2	29	28	355	−38.1	36	12	370	−28.5	45	27	364	−33.2	34	28	348	−40.9	----	24	359	−35.5	36	28	351	−40.6	----
9,000	27	314	−39.7	29	25	307	−44.6	----	11	320	−35.8	43	26	315	−40.3	----	27	300	−46.5	----	24	310	−42.4	----	26	302	−47.0	----
10,000	27	271	−45.6	----	21	264	−49.9	----	10	277	−43.6	----	25	272	−46.2	----	27	257	−50.3	----	22	267	−48.5	----	24	259	−51.8	----
11,000	27	233	−51.1	----	20	226	−53.3	----	9	238	−51.4	----	25	233	−50.7	----	26	221	−53.1	----	21	229	−53.1	----	20	222	−54.1	----
12,000	26	199	−55.5	----	17	193	−54.2	----	8	204	−59.3	----	24	200	−53.8	----	26	189	−54.8	----	20	196	−56.1	----	17	190	−53.9	----
13,000	24	170	−57.6	----	14	165	−54.9	----	5	172	−65.9	----	23	171	−56.1	----	23	161	−55.7	----	18	167	−57.4	----	15	163	−53.7	----
14,000	23	145	−59.5	----	13	141	−56.0	----					22	145	−57.9	----	21	137	−57.7	----	15	143	−58.9	----	14	139	−53.8	----
15,000	21	123	−60.9	----	10	121	−57.5	----					20	124	−59.4	----	15	116	−59.2	----	14	121	−60.2	----	11	119	−54.6	----
16,000	17	105	−62.4	----	8	103	−58.4	----					17	105	−61.1	----	8	99	−59.8	----	11	103	−61.0	----	8	102	−54.6	----
17,000	13	89	−62.9	----	5	87	−58.1	----					15	89	−62.5	----					7	88	−61.6	----				
18,000													10	76	−62.1	----												
19,000													8	65	−61.2	----												
20,000													5	54	−59.8	----												

See footnotes at end of table.

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centrigrade, and relative humidities in percent, obtained by airplanes and radiosondes during December 1941*—Continued

Altitude (meters), m. l. s.	San Antonio, Tex. (174 m.)				San Diego, Calif.[1] (19 m.)				Sault Ste. Marie, Mich. (221 m.)				Seattle, Wash.[1] (27 m.)				Spokane, Wash. (598 m.)				Washington, D. C. (25 m.)				Anchorage, Alaska (42 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	998	11.5	81	27	1,014	13.5	84	31	988	−4.2	87	20	1,010	4.6	83	31	943	0.1	88	29	1,017	4.0	73	31	995	−7.9	85
500	31	961	12.8	71	27	957	12.8	60	31	954	−5.3	88	20	953	1.9	79					29	959	3.9	64	31	939	−4.6	75
1,000	31	905	11.6	66	27	902	10.7	50	31	895	−6.4	86	20	896	−1.1	78	31	897	−1.0	87	29	902	1.9	63	31	881	−5.5	68
1,500	31	853	9.8	57	27	850	8.4	42	31	840	−6.4	78	20	840	−3.9	81	31	842	−3.3	85	29	848	.6	61	31	826	−8.2	70
2,000	31	802	8.2	48	27	800	5.9	38	31	787	−7.7	74	20	789	−6.5	80	31	790	−5.8	82	29	796	−.6	58	31	775	−11.4	74
2,500	31	755	7.1	43	27	752	4.0	31	31	738	−9.4	70	20	740	−9.3	75	31	741	−8.0	78	29	748	−2.0	53	31	725	−14.3	75
3,000	31	710	5.0	39	27	706	1.1	29	31	692	−11.5	68	20	693	−12.3	70	31	695	−10.5	74	29	702	−3.9	48	30	679	−17.1	73
4,000	31	628	−.6	33	27	623	−4.4	27	31	606	−16.6	65	20	607	−18.5	58	31	609	−16.2	68	29	618	−10.0	45	30	593	−23.3	69
5,000	31	553	−7.3	31	27	548	−10.8	27	30	531	−22.6	61	20	530	−24.6	58	30	533	−22.2	65	29	542	−15.5	42	29	516	−29.7	67
6,000	31	486	−13.7	30	26	480	−18.3	31	30	462	−29.4	60	19	462	−31.1	61	30	464	−29.0	62	29	474	−22.3	42	28	448	−36.4	65
7,000	30	425	−20.7	27	26	419	−25.1	37	30	401	−36.4	60	18	400	−37.7	67	30	402	−36.5	59	27	413	−29.4	40	28	387	−43.2	----
8,000	30	371	−27.6	26	24	364	−33.3	----	29	346	−43.2	----	17	345	−44.5	----	28	348	−43.8	----	27	358	−35.9	39	28	333	−49.5	----
9,000	30	322	−34.5	26	23	315	−40.7	----	28	298	−48.5	----	16	297	−49.8	----	28	299	−49.7	----	27	309	−42.3	----	27	286	−54.3	----
10,000	28	278	−41.3	----	22	271	−47.2	----	25	256	−52.2	----	15	254	−53.1	----	27	256	−53.6	----	26	266	−48.4	----	27	244	−56.2	----
11,000	27	240	−48.0	----	20	233	−52.7	----	23	220	−53.6	----	14	218	−53.5	----	27	220	−55.5	----	26	229	−54.0	----	25	209	−55.0	----
12,000	27	205	−54.1	----	19	199	−56.5	----	22	188	−54.1	----	13	187	−51.7	----	25	188	−55.0	----	26	195	−57.4	----	24	178	−54.6	----
13,000	26	175	−59.2	----	17	170	−59.9	----	22	161	−54.9	----	13	160	−51.5	----	24	160	−54.1	----	24	166	−59.4	----	23	152	−53.2	----
14,000	25	149	−62.8	----	9	145	−61.6	----	19	137	−55.9	----	11	137	−52.6	----	24	137	−54.6	----	21	142	−60.7	----	21	130	−52.7	----
15,000	22	127	−65.8	----	8	123	−63.1	----	9	117	−56.3	----	7	117	−53.3	----	20	118	−55.2	----	16	120	−63.5	----	16	111	−52.0	----
16,000	19	107	−68.2	----	6	104	−65.0	----	5	100	−56.7	----					11	100	−55.7	----	13	102	−65.6	----	8	95	−51.2	----
17,000	18	91	−69.8	----													8	86	−57.0	----	9	87	−66.5	----				
18,000	13	77	−69.5	----																	6	73	−66.6	----				
19,000	6	65	−68.3	----																								

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Altitude (meters), m. s. l.	Fairbanks, Alaska (156 m.)				Juneau, Alaska (49 m.)				Ketchikan, Alaska (26 m.)				San Juan, P. R. (15 m.)				Swan Island, West Indies (10 m.)				Pearl Harbor, T. H. (7 m.)				Swan Island, West Indies (10 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number o observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	31	986	−18.5	78	31	1,000	−0.9	82	28	1,004	2.0	83	28	1,014	24.0	89	31	1,013	26.0	84	24	1,014	23.1	80	30	1012	26.2	80
500	31	943	−13.7	77	31	945	−3.2	80	28	946	−0.2	84	28	960	21.9	90	31	957	23.1	87	24	948	20.3	78	30	958	23.3	83
1,000	31	883	−11.5	74	31	887	−5.5	80	28	889	−3.1	82	28	907	18.8	88	31	904	20.2	84	24	904	17.6	78	30	904	20.3	79
1,500	31	827	−11.1	69	31	832	−7.8	80	28	834	−5.8	79	28	856	15.7	85	31	853	17.4	81	24	853	15.5	68	30	853	17.6	75
2,000	31	775	−13.5	67	30	780	−10.0	78	28	782	−8.4	75	28	806	13.0	80	31	804	15.0	76	24	804	14.7	46	30	804	14.8	74
2,500	31	725	−16.2	66	29	730	−12.7	77	27	733	−11.0	69	28	759	11.1	65	31	758	12.8	69	24	758	13.2	34	30	758	12.3	70
3,000	31	678	−19.2	63	29	684	−15.6	69	27	687	−14.0	65	28	715	9.1	52	31	714	10.4	62	24	714	11.0	29	30	714	10.3	60
4,000	31	592	−25.5	62	27	598	−22.0	67	27	601	−20.0	61	28	633	3.9	40	30	633	5.9	47	24	632	5.1	29	30	633	5.7	53
5,000	30	515	−32.0	60	27	521	−28.2	67	27	524	−26.3	61	27	560	−1.3	33	29	560	0.7	41	24	558	−0.7	30	30	560	0.7	48
6,000	28	446	−38.9	59	24	453	−33.8	65	26	456	−32.8	60	27	493	−7.0	29	28	494	−5.2	39	24	491	−7.4	30	29	484	−5.0	45
7,000	27	385	−45.6	----	20	391	−40.7	----	24	394	−39.1	61	26	433	−13.5	26	28	434	−11.5	38	23	432	−14.1	26	29	434	−11.4	43
8,000	22	330	−51.6	----	20	337	−46.3	----	22	340	−44.8	----	24	379	−20.3	24	28	381	−18.5	37	23	378	−21.0	24	29	380	−18.1	41
9,000	20	283	−56.4	----	18	289	−50.8	----	20	292	−49.1	----	24	330	−27.5	23	28	332	−25.8	37	22	329	−28.6	22	29	332	−25.1	39
10,000	19	241	−58.8	----	18	248	−53.3	----	18	251	−51.8	----	23	287	−34.8	22	27	289	−33.3	36	21	286	−35.6	----	29	280	−32.2	38
11,000	16	206	−58.7	----	16	212	−53.9	----	16	215	−53.4	----	23	248	−42.3	----	26	249	−40.9	----	18	247	−42.3	----	28	250	−39.9	----
12,000	13	175	−57.5	----	15	181	−54.0	----	14	184	−53.0	----	23	214	−49.7	----	26	216	−48.3	----	13	213	−49.4	----	27	216	−47.7	----
13,000	10	150	−56.3	----	11	154	−51.8	----	12	157	−52.7	----	23	183	−56.8	----	25	184	−55.8	----	10	182	−56.2	----	26	185	−55.7	----
14,000	8	128	−55.5	----	8	132	−51.4	----	8	134	−52.4	----	22	156	−63.8	----	25	158	−63.1	----	9	155	−63.4	----	25	158	−63.7	----
15,000	6	109	−55.5	----	5	112	----	----	7	115	−51.9	----	21	132	−69.8	----	25	134	−69.9	----	5	132	−69.6	----	24	134	−71.5	----
16,000													20	111	−74.8	----	24	113	−75.5	----					24	112	−77.9	----
17,000													15	94	−78.0	----	18	95	−80.2	----					21	94	−82.5	----
18,000													11	78	−78.0	----	17	79	−83.5	----					17	78	−85.0	----
19,000													6	66	−74.9	----	7	6	−83.1	----					8	66	−84.0	----

[1] U. S. Navy.
[2] Airplane observations.

NOTE.—All observations taken at 11 p. m. 75th meridian time, except at Lakehurst, N. J. where they are taken near 5 a. m., at Norfolk, Va., and Seattle, Wash. where they are taken at about 6 a. m. and at Pearl Harbor, T. H., Coco Solo, C. Z., and St. Thomas, V. I. at about 7 a. m.

None of the means included in this table are based on less than 15 surface or 5 standard level observations.

Number of observations refers to pressure only as temperature and humidity data are missing for some observations at certain levels, also, the humidity data are not used in daily observations when the temperature is below −40.0° C.

TABLE 2.—*Free-air resultant winds based on pilot balloon observations made near 5 p. m. (75th meridian time) during December 1941. Directions given in degrees from North (N=360°, E=90°, S=180°, W=270°)—Velocities in meters per second*

Altitude (meters) m. s. l.	Abilene, Tex. (537 m.)			Albuquerque, N. Mex. (1,630 m.)			Atlanta, Ga. (299 m.)			Billings, Mont. (1,095 m.)			Bismarck, N. Dak. (512 m.)			Boise, Idaho (866 m.)			Brownsville, Tex. (7 m.)			Buffalo, N. Y. (220 m.)			Burlington, Vt. (132 m.)			Charleston, S. C. (17 m.)			Chicago, Ill. (192 m.)			Cincinnati, Ohio (152 m.)			Denver, Colo. (1,627 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	29	217	1.8	31	276	2.4	27	317	1.5	27	247	3.7	30	272	2.0	27	125	2.2	26	53	2.7	29	250	2.7	30	212	0.4	28	217	0.5	27	252	2.7	30	247	1.3	28	74	0.4
500							27	317	2.0										25	73	3.4	29	242	5.1	30	230	3.5	28	274	0.9	27	238	4.1	30	233	3.0			
1,000	30	208	4.1				27	244	1.4				30	269	4.0	27	136	3.2	21	64	1.8	21	246	9.2	25	253	6.4	27	261	3.3	21	248	5.1	25	244	6.5			
1,500	26	240	5.6				26	284	4.5	27	247	7.0	29	290	6.1	27	169	4.2	17	278	2.1	15	266	8.4	19	281	8.0	27	264	6.4	17	266	8.3	22	254	8.5			
2,000	26	254	8.4	31	263	2.7	26	280	7.8	27	261	7.4	27	292	7.0	25	199	4.6	15	226	3.6	10	260	9.4	13	309	12.2	26	265	8.3	15	273	12.0	18	268	10.2	28	212	0.7
2,500	25	256	9.5	30	269	4.9	25	283	9.9	27	270	8.4	25	294	10.0	22	224	6.0	13	227	5.4				12	306	14.0	26	264	9.6	13	272	12.8	16	276	12.9	28	282	2.1
3,000	25	255	10.5	28	269	7.2	24	278	11.6	25	275	9.8	24	292	12.2	20	240	6.6	13	235	6.2							26	266	12.0	11	272	16.2	16	281	14.3	28	286	4.3
4,000	24	261	13.5	24	283	10.5	23	276	16.4	22	278	15.6	23	286	13.9	10	257	5.0	11	244	10.4							25	264	16.7				11	290	18.5	28	285	7.5
5,000	22	263	15.6	21	275	12.9	22	273	20.0	18	282	14.7	22	277	14.6	10	269	7.6	10	253	12.6							20	266	20.6							24	283	11.4
6,000	19	266	16.9	19	267	14.3	19	278	22.6	15	288	15.2	20	283	17.9	10	266	8.8										17	269	24.1							23	275	12.2
8,000	13	262	22.1	12	275	19.5							15	286	22.5																						18	292	17.6
10,000	12	260	26.5										10	287	25.8																						12	288	24.3

Altitude (meters) m. s. l.	El Paso, Tex. (1,196 m.)			Ely, Nev. (1,910 m.)			Grand Junction, Colo. (1,413 m.)			Greensboro, N. C. (271 m.)			Havre, Mont. (767 m.)			Jacksonville, Fla. (16 m.)			Las Vegas, Nev. (570 m.)			Little Rock, Ark. (88 m.)			Medford, Oreg. (410 m.)			Miami, Fla. (10 m.)			Minneapolis, Minn. (265 m.)			Mobile, Ala. (66 m.)*			Nashville, Tenn. (194 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	31	276	2.3	31	181	2.2	30	303	0.6	28	274	1.1	28	246	3.9	29	17	1.2	31	73	0.2	27	265	1.0	24	345	0.6	31	86	1.9	27	272	0.9	23	337	1.2	28	230	1.3
500										28	262	2.9				29	232	0.5				27	257	2.8	24	26	0.2	31	85	3.1	27	244	2.3	23	359	1.6	28	209	2.7
1,000										27	270	4.7	28	248	7.6	27	222	3.0	31	133	0.6	23	263	3.6	23	183	3.5	29	92	1.3	23	275	6.7	23	332	2.4	27	217	4.0
1,500	31	268	2.9							27	277	7.5	27	261	11.7	25	234	4.5	30	195	1.7	21	273	3.8	22	220	5.0	28	223	1.0	22	278	7.8	22	300	2.8	23	237	5.4
2,000	31	262	3.8	31	173	2.8	30	286	0.7	27	280	10.4	26	268	11.6	23	263	6.1	30	217	3.5	19	265	5.5	17	222	6.9	24	259	2.5	20	279	9.9	22	281	4.8	18	280	6.9
2,500	31	264	6.7	31	199	3.6	30	191	2.7	27	282	11.6	23	272	12.6	22	273	7.0	29	232	5.2	19	264	8.6	11	224	8.0	24	249	3.6	18	285	11.1	21	267	7.7	17	285	9.3
3,000	29	274	8.6	27	233	4.1	30	228	4.2	25	277	14.1	22	280	13.2	21	273	9.5	28	248	6.9	16	277	11.2	11	240	9.2	21	242	3.6	16	285	13.1	19	276	8.8	15	285	10.1
4,000	27	279	12.2	23	259	9.6	21	256	8.5	24	281	18.5	17	284	13.2	20	266	12.8	26	260	8.1	13	283	13.1				21	254	6.0	15	289	14.6	18	271	12.9			
5,000	25	278	11.8	17	262	12.1	18	278	9.4	21	278	20.9	14	288	13.6	18	268	15.4	21	267	10.8							18	256	9.4	15	295	19.5	13	255	14.5			
6,000	24	278	15.7	15	275	12.8	13	290	13.0	19	275	24.6	13	296	14.2	14	273	17.6	20	274	14.0							18	262	12.2	14	294	21.8						
8,000	20	279	20.3	10	296	17.4				14	276	33.6							14	300	16.6							16	262	18.1	10	309	28.8						
10,000	13	295	20.8	10	300	23.0													11	293	18.6							11	269	21.1									

Altitude (meters) m. s. l.	New York, N. Y. (15 m.)			Oakland, Calif. (8 m.)			Oklahoma City, Okla. (402 m.)			Omaha, Nebr. (306 m.)			Phoenix, Ariz. (338 m.)			Rapid City, S. Dak. (982 m.)			St. Louis, Mo. (181 m.)			San Antonio, Tex. (180 m.)			San Diego, Calif. (15 m.)			Sault Ste. Marie, Mich. (230 m.)			Seattle, Wash. (12 m.)			Spokane, Wash. (603 m.)			Washington, D. C. (24 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	27	296	4.8	29	216	2.3	27	248	1.5	26	270	1.9	31	150	0.3	28	325	1.2	30	234	1.7	28	31	1.2	28	275	2.5	21	304	2.8	26	174	1.1	26	164	0.9	29	298	2.4
500	27	286	7.0	29	255	3.0	27	276	0.9	26	267	3.2	31	160	0.4				30	242	2.9	28	40	0.7	28	290	2.9	21	287	3.4	26	186	3.2				29	271	3.3
1,000	26	293	8.8	26	268	4.2	27	227	3.6	23	275	5.4	31	161	1.5	28	321	1.3	27	254	5.7	24	227	2.1	27	278	1.3	15	298	8.0	22	193	4.5	26	182	2.4	27	275	6.9
1,500	20	292	11.2	21	284	5.5	24	261	4.4	18	265	8.0	31	191	2.3	28	285	4.0	22	260	7.9	24	245	3.9	27	279	1.7				16	179	3.8	20	203	2.9	27	288	9.3
2,000	12	311	10.9	18	290	6.9	23	270	6.6	15	276	10.3	30	222	3.0	28	286	5.9	22	260	9.2	22	253	5.7	24	280	2.4				14	182	3.3	15	202	3.9	25	285	11.0
2,500				15	288	9.1	23	267	9.0	14	278	11.7	29	253	4.1	26	287	9.3	18	266	10.1	22	253	7.7	23	275	4.1				12	212	2.6	13	219	4.2	21	289	12.9
3,000				14	296	10.9	22	271	11.4	14	275	12.0	29	263	6.5	26	286	9.6	18	270	11.7	21	252	9.8	19	280	5.2				11	306	1.2	12	240	3.8	20	289	14.3
4,000				10	287	10.6	20	268	12.6	13	276	15.6	22	264	8.1	23	281	11.6	17	267	15.1	19	261	13.7	13	272	9.4										19	289	18.4
5,000							17	276	15.8	12	293	18.0	19	274	10.2	21	281	13.4	16	269	14.5	18	256	16.7													16	291	19.4
6,000							15	272	16.8				17	273	11.3	18	282	16.6	14	272	17.4	17	260	18.5													14	294	24.7
8,000													11	280	12.6	12	282	20.6	10	288	20.7	13	258	20.0															
10,000																11	274	27.1																					

*Station moved 2 p. m., Dec. 1, to altitude 66 m.

TABLE 3.—*Maximum free air wind velocities (m. p. s.), for different sections of the United States based on pilot balloon observations during December 1941*

Section	Surface to 2,500 meters (m. s. l.)					Between 2,500 and 5,000 meters (m. s. l.)					Above 5,000 meters (m. s. l.)				
	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station
Northeast [1]	43.1	WNW	1,910	4	Caribou, Maine	51.6	WSW	4,800	26	Pittsburgh, Pa.	57.5	NW	5,650	21	Portland, Maine.
East-Central [2]	43.6	SW	1,150	22	Louisville, Ky	50.6	NNW	4,170	6	Knoxville, Tenn.	81.8	WSW	7,410	26	Huntington, W. Va.
Southeast [3]	34.5	WSW	1,910	23	Birmingham, Ala.	46.6	NNW	4,020	6	Atlanta, Ga.	66.0	WNW	11,020	31	Jacksonville, Fla.
North-Central [4]	50.4	SW	1,570	3	Marquette, Mich.	47.2	WNW	4,610	13	LaCrosse, Wis.	78.0	N	8,740	5	Fargo, N. Dak.
Central [5]	43.5	SSW	1,110	4	Omaha, Nebr.	51.2	NW	4,710	8	Des Moines, Iowa.	73.6	W	12,470	6	Wichita, Kans.
South-Central [6]	37.6	WSW	1,900	25	Houston, Tex.	44.4	SW	3,690	25	Waco, Tex.	84.0	WSW	9,970	5	Oklahoma City, Okla.
Northwest [7]	36.1	WSW	2,480	19	Great Falls, Mont.	45.0	WSW	2,840	19	Great Falls, Mont.	62.0	WNW	8,230	18	Great Falls, Mont.
West-Central [8]	42.6	SW	2,420	3	Casper, Wyo.	52.6	SW	5,000	16	Ely, Nev.	66.0	NNW	12,770	2	Pueblo, Colo.
Southwest [9]	48.8	NW	1,390	24	Burbank, Calif.	47.5	WNW	4,220	25	El Paso, Tex.	77.5	W	7,380	4	Albuquerque, N. Mex.

[1] Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, and northern Ohio.
[2] Delaware, Maryland, Virginia, West Virginia, Southern Ohio, Kentucky, eastern Tennessee, and North Carolina.
[3] South Carolina, Georgia, Florida, and Alabama.
[4] Michigan, Wisconsin, Minnesota, North Dakota, and South Dakota.
[5] Indiana, Illinois, Iowa, Nebraska, Kansas, and Missouri.
[6] Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except El Paso), and western Tennessee.
[7] Montana, Idaho, Washington, and Oregon.
[8] Wyoming, Colorado, Utah, northern Nevada, and northern California.
[9] Southern California, southern Nevada, Arizona, New Mexico, and extreme west Texas.

AEROLOGICAL SUMMARY FOR THE YEAR 1941

By HOMER D. DYCK

At the end of 1941, radiosonde observations were being taken at a total of 40 Weather Bureau stations. This number included 29 in the United States, 7 in Alaska, 1 at San Juan, P. R., 1 at Swan Island, and 2 on ships at sea. In addition, 5 Navy stations were taking radiosonde observations and 3 Navy stations were taking airplane observations. At the end of the previous year there were 26 Weather Bureau stations taking radiosonde observations while the number of Navy stations was the same.

Beginning in April, observations were taken twice a day at all Weather Bureau radiosonde stations in the United States. The customary special upper air observations were taken during the hurricane season at selected stations in the United States and West Indies. Radiosonde observations on board Coast Guard cutters were continued in 1941.

Monthly mean values of temperature, pressure, and relative humidity for all the standrd levels of the free air have been published each month as table 1 under Aerological Observations in the MONTHLY WEATHER REVIEW.

Table 1 for the year 1941, tabulates annual mean pressures, temperatures and relative humidities for all stations for which such data were available. The annual mean values shown in table 1 are computed by averaging mean monthly values so that data for each month are given the same weight. The number of observations for each month and level may be found by referring to the previously published monthly tables.

Annual mean values for both 1940 and 1941 are available for 18 stations in the United States. These stations are shown in the annual table No. 1 for each of these 2 years and are as follows: Bismarck, N. Dak., Charleston, S. C., Denver, Colo., El Paso, Tex., Ely, Nev., Lakehurst, N. J., Medford, Oreg., Nashville, Tenn., Norfolk, Va., Oakland, Calif., Oklahoma City, Okla., Omaha, Nebr., Pensacola, Fla., Phoenix, Ariz., San Diego, Calif., Sault Ste. Marie, Mich., Seattle, Wash., and Washington, D. C.

Based on available annual mean values it is found that up to about 10,000 meters, temperatures were higher in 1941 than in 1940 east of the Rocky Mountains and lower to the west of them. Above 10,000 meters temperatures were generally higher in 1941 than in 1940 over all parts of the country. It may be noted that surface temperatures in 1940 averaged above normal over the western half of the country and below normal over the eastern half whereas in 1941 temperatures averaged above normal over the entire country.

Annual mean relative humidities were generally higher in 1941 than in 1940 over the western half of the country and lower over the eastern half up to about 4,000 meters. In this connection it may be noted that although precipitation was above normal over the western half of the country in 1940, it was even greater in 1941, while in the East, although precipitation was nearly normal in 1940, it was considerably below normal in 1941. It may be said then that conditions leading to heavy precipitation over the western half of the country and low precipitation over the eastern half were intensified in 1941.

Following much the same pattern as shown by the comparisons of 1940 and 1941 temperatures and relative humidities, mean annual pressures for 1941 were higher than in 1940 over the eastern half of the country and lower over the western half up to about 13,000 meters. From 13,000 to 17,000 meters pressures averaged the same or higher than in 1940.

At the end of 1941, the Weather Bureau had 143 pilot-balloon stations of which 129 were in the United States, 11 in Alaska, 1 in Swan Island, 1 in Puerto Rico and 1 in Hawaii. This represented an increase of 11 stations over a year ago. All pilot balloon stations were using helium gas for inflation and nearly all stations in the United States were making 4 observations daily.

At the end of the year 51 stations were using 100-gram balloons for the 5 p. m. (E. S. T.) observations, representing an increase of 10 for the year. The higher ascensional rate of these balloons permits observations of winds at much higher levels than with the use of the 30-gram balloons.

Plans for reducing radiosonde data to punch cards were completed during the year as well as plans for continuation of punching of current pilot balloon and radiosonde data.

The lowest observed free-air temperature in the United States during 1941 was −87.9° C. observed over Miami, Fla., on January 2, at a height of 16,900 meters (about 12 miles) above sea level.

Monthly resultant wind directions and velocities have been computed for the 1,500 and 3,000 m. levels from the 5 a. m. (E. S. T.) observations for all stations and have been shown each month in the MONTHLY WEATHER REVIEW on charts VIII and IX. Similar 5 p. m. result-

ants have been computed for the 5,000 and 10,000 meter levels and shown on charts X and XI. Monthly resultants (5. p. m., E. S. T.) have also been computed for all standard levels at 39 selected stations. These resultants have been published regularly in the REVIEW as table 2 of the Aerological Summary.

The 1941 annual 5 p. m., resultants are shown in table 2 for the selected list of stations. At most of the standard levels up to and including 4,000 meters, a turning to southward from 1940 was noted. Exceptions were a turning to northward from the previous year over California and in the Northeast. It may be noted at this point that mean surface temperatures for the United States as a whole were higher in 1941 than in 1940.

At standard levels from the surface up to about 3,000 meters annual wind resultant velocities had a tendency to be lower in 1941 than in 1940 over the Southeastern States and the West and higher over the remainder of the country.

Table 3 shows the maximum free-air wind velocities and their directions for various sections of the United States during the year 1941 as determined by pilot balloon observations. The extreme velocity for the year was 91.6 meters per second (205 miles per hour). During the last 5 years the extreme wind velocity for the year occurred in the layer above 5,000 meters. The highest velocity during the last 5 years was 98.4 m. p. s. (220 miles per hour) recorded in November 1940. In the layer between 2,500 and 5,000 meters the highest velocity in the last 5 years occurred in February 1941. (See Table 3.) The highest velocity in the layer below 2,500 meters during the 5-year period was 63.3 m. p. s. (142 miles per hour) in June 1938.

Table 4 gives a tabulation by months of the altitude of the level at which a mean temperature of 0° C. was observed at all stations making either airplane or radiosonde observations. The level of mean freezing temperatures was highest over the northern half of the country in July and over the southern half in August. This level reached a mean maximum altitude over Phoenix, Ariz., and San Antonio, Tex., in August when it was at an altitude of 5,100 meters (about 3.2 miles).

A more detailed comparison of upper air conditions of the years 1940 and 1941 can be made by reference to the 1940 Annual Summary of Aerological Observations which was published in the MONTHLY WEATHER REVIEW for December 1940.

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during year 1941*

Altitude (meters) m. s. l.	Stations and elevations in meters above sea level																							
	Atlanta, Ga. (300 m.)				Bismarck, N. Dak. (505 m.)				Brownsville, Tex. (6 m.)				Buffalo, N. Y. (221 m.)				Charleston, S. C. (14 m.)				Denver, Colo. (1,616 m.)				El Paso, Tex. (1,193 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	315	983	15.0	76	363	956	4.8	79	366	1,015	20.9	90	348	990	7.3	79	365	1,016	15.3	88	355	838	7.2	69	355	882	15.5	56
500	314	961	16.1	69					366	958	19.7	85	348	958	7.9	74	365	960	16.3	71								
1,000	314	906	14.4	66	362	900	6.3	70	366	904	17.7	76	348	901	5.6	72	365	905	13.9	65								
1,500	314	854	12.0	64	362	847	5.1	67	366	853	15.7	67	348	847	3.2	70	365	853	11.4	62					355	851	15.8	52
2,000	314	804	9.7	61	362	796	3.2	64	366	804	13.7	60	347	796	1.2	67	365	803	9.0	58	354	800	8.5	61	355	802	12.9	51
2,500	314	757	7.2	57	362	748	.7	62	366	757	11.4	54	346	748	−1.0	63	365	756	6.7	53	353	752	5.7	57	355	755	9.6	51
3,000	314	712	4.5	55	362	703	−2.0	61	365	713	8.8	51	345	702	−3.2	59	364	711	4.2	50	353	707	2.6	57	355	710	6.1	52
4,000	309	629	−0.9	50	358	619	−7.9	58	362	632	2.9	48	340	618	−8.2	53	362	628	−1.1	46	349	624	−4.4	58	352	628	−0.7	53
5,000	308	554	−6.6	46	358	544	−14.3	55	361	558	−3.4	47	335	543	−14.1	49	357	554	−7.0	44	345	549	−11.4	58	350	554	−7.3	51
6,000	305	487	−12.8	42	357	476	−21.1	52	356	491	−10.1	45	332	475	−20.6	47	353	486	−13.4	42	336	481	−18.3	55	346	486	−14.0	48
7,000	297	426	−19.5	40	356	415	−28.2	51	351	430	−16.9	43	327	414	−27.6	44	351	426	−20.1	40	334	420	−25.4	51	340	426	−21.1	44
8,000	295	372	−26.5	----	352	360	−35.4	----	347	376	−23.8	41	319	360	−34.6	----	348	371	−27.3	40	328	365	−33.0	48	337	371	−27.8	42
9,000	293	323	−33.5	----	347	311	−42.6	----	340	327	−31.0	40	311	311	−41.3	----	345	322	−34.8	38	318	316	−40.3	----	333	322	−34.9	42
10,000	288	280	−40.5	----	344	268	−49.0	----	336	284	−38.3	----	300	268	−47.1	----	341	279	−42.1	----	306	272	−47.0	----	326	278	−42.1	----
11,000	----	----	----	----	336	230	−53.2	----	326	245	−45.4	----	292	230	−51.1	----	339	240	−49.0	----	290	234	−52.1	----	325	240	−48.5	----
12,000	----	----	----	----	331	196	−54.8	----	317	210	−52.2	----	280	197	−53.9	----	336	206	−54.7	----	280	200	−56.2	----	321	206	−53.7	----
13,000	----	----	----	----	327	168	−55.3	----	307	180	−57.6	----	270	168	−56.3	----	325	175	−59.4	----	264	171	−57.1	----	311	176	−57.9	----
14,000	----	----	----	----	318	144	−55.8	----	298	153	−63.9	----	253	144	−57.7	----	318	149	−63.2	----	251	146	−58.7	----	305	150	−61.8	----
15,000	----	----	----	----	295	122	−56.6	----	284	130	−68.5	----	231	123	−58.8	----	306	127	−66.4	----	237	124	−60.4	----	298	127	−64.9	----
16,000	----	----	----	----	265	105	−57.2	----	258	110	−71.7	----	206	104	−59.4	----	286	107	−68.1	----	207	106	−61.3	----	279	108	−66.9	----
17,000	----	----	----	----	202	90	−52.6	----	222	93	−72.6	----	173	90	−59.1	----	256	91	−67.9	----	171	90	−61.3	----	257	91	−66.7	----
18,000	----	----	----	----	----	----	----	----	160	78	−69.9	----	----	----	----	----	205	77	−66.3	----	98	77	−60.5	----	206	77	−65.0	----
19,000	----	----	----	----	----	----	----	----	101	66	−66.3	----	----	----	----	----	130	67	−63.7	----	----	----	----	----	124	66	−62.6	----

See footnotes at end of table.

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during year 1941*—Continued

Altitude (meters) m. s. l.	Ely, Nev. (1,908 m.)				Great Falls, Mont. (1,127 m.)				Lakehurst, N. J.[1] (39 m.)				Medford, Oreg. (401 m.)				Miami, Fla. (4 m.)				Nashville, Tenn. (180 m.)				Norfolk, Va.[1 2] (10 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	364	809	4.6	69	363	886	6.9	62	353	1012	7.9	80	363	968	11.8	71	362	1017	20.8	89	365	997	13.7	75	283	1019	12.9	77
500									353	958	8.7	70	363	956	12.5	69	362	960	19.9	85	365	960	14.5	68	283	961	13.2	63
1,000									353	901	6.9	66	363	901	10.9	65	362	906	17.0	81	365	904	12.0	68	283	905	11.0	58
1,500					363	847	7.2	59	353	848	4.9	62	363	848	7.9	67	362	855	14.4	74	364	852	9.6	67	282	852	8.8	55
2,000	364	800	6.2	65	362	797	4.5	58	353	797	2.8	59	363	798	4.9	69	362	805	12.2	66	364	802	7.2	64	282	802	6.6	53
2,500	364	752	5.0	60	361	749	1.3	59	353	749	0.7	56	363	750	2.0	66	362	758	9.9	58	363	754	4.8	60	280	754	4.3	49
3,000	364	707	1.6	59	360	704	−2.0	60	353	704	−1.7	53	363	705	−0.8	61	362	714	7.5	53	362	709	2.4	57	279	709	1.8	45
4,000	363	624	−5.2	58	359	620	−8.4	61	351	620	−6.9	49	360	621	−6.7	55	360	632	2.1	47	356	626	−3.0	50	273	625	−3.6	41
5,000	362	549	−12.1	56	359	544	−14.9	58	347	544	−12.6	46	359	546	−13.1	51	357	558	−3.8	45	351	551	−8.8	46	224	550	−10.0	36
6,000	361	480	−19.1	53	357	476	−21.6	55	339	477	−18.9	45	357	478	−20.0	49	352	491	−10.0	43	341	484	−15.2	43				
7,000	361	419	−26.3	51	357	415	−28.8	54	337	416	−25.6	47	356	417	−27.3	48	350	430	−16.7	42	329	423	−21.9	41				
8,000	357	364	−33.7	50	351	360	−36.3		331	362	−32.5		353	362	−34.8	47	346	376	−23.6	41	323	368	−29.1	40				
9,000	349	315	−41.0		350	311	−43.6		327	313	−39.3		353	312	−42.2		345	327	−30.8	40	314	320	−36.2					
10,000	344	272	−47.8		348	267	−50.2		316	270	−45.3		350	269	−48.7		340	284	−38.3		306	276	−43.0					
11,000	333	233	−52.5		344	229	−54.5		310	233	−50.3		348	231	−53.4		336	245	−45.8		299	238	−49.2					
12,000	326	199	−54.9		338	196	−55.7		292	199	−54.2		347	198	−55.7		333	210	−53.0		296	204	−53.9					
13,000	323	170	−56.2		330	167	−55.3		279	170	−57.1		336	169	−56.0		324	180	−59.6		284	174	−57.6					
14,000	315	145	−57.5		318	143	−55.3		261	146	−59.0		329	144	−56.5		316	153	−65.5		278	148	−60.8					
15,000	302	124	−59.3		303	122	−55.9		231	124	−60.6		312	123	−57.3		310	129	−70.0		262	126	−63.3					
16,000	279	106	−60.5		268	104	−56.7		201	106	−61.3		273	105	−58.1		300	109	−72.7		243	107	−64.9					
17,000	228	90	−60.7		221	89	−56.8		156	90	−61.6		225	90	−58.5		261	92	−72.7		217	91	−64.8					
18,000					158	76	−56.5						151	76	−53.3		211	78	−70.1		167	77	−63.5					
19,000																	143	66	−66.6									

Altitude (meters) m. s. l.	St. Paul, Minn. (224 m.)				San Diego, Calif.[1] (19 m.)				Sault Ste. Marie, Mich. (221 m.)				Seattle Wash.[1] (27 m.)				Spokane, Wash. (598 m.)				Washington, D. C. (25 m.)			
	Number of Observations	Pressure	Temperature	Relative Humidity	Number of Observations	Pressure	Temperature	Relative Humidity	Number of Observations	Pressure	Temperature	Relative Humidity	Number of Observations	Pressure	Temperature	Relative Humidity	Number of Observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	363	989	7.4	80	342	1,012	16.7	82	366	989	3.8	84	336	1,013	11.5	80	365	945	8.5	77	343	1,016	11.9	72
500	363	957	7.2	75	342	956	15.3	72	366	956	4.4	80	336	957	10.1	74					343	959	11.7	65
1,000	363	900	6.0	72	342	901	14.5	57	366	899	2.8	76	336	901	7.4	73	365	900	9.2	69	343	903	9.3	64
1,500	363	847	4.7	69	342	849	12.7	47	366	845	.9	73	335	848	4.4	74	365	847	6.6	65	341	850	7.1	63
2,000	363	796	2.8	65	342	800	10.5	41	366	790	−.9	70	335	797	1.6	72	365	797	3.7	64	340	800	4.8	62
2,500	362	748	.5	61	341	753	7.8	38	366	745	−3.0	66	335	748	−1.3	69	346	749	.1	65	340	752	2.5	59
3,000	362	703	−1.9	59	340	708	5.0	35	366	699	−5.4	63	335	703	−4.0	65	362	703	−3.0	64	340	707	.2	56
4,000	356	619	−7.4	55	333	626	−1.0	32	362	613	−10.6	60	334	618	−10.0	59	358	619	−9.2	61	335	623	−5.2	52
5,000	347	544	−13.4	51	332	551	−7.4	32	355	540	−16.5	56	333	542	−16.5	57	356	543	−15.7	58	328	548	−10.8	49
6,000	342	476	−19.9	47	328	484	−14.3	33	349	471	−23.1	54	331	474	−23.4	58	352	475	−22.5	55	319	480	−17.2	46
7,000	338	415	−26.9	45	322	424	−21.5	34	342	410	−29.9	46	328	412	−30.6	60	345	414	−29.8	53	304	420	−23.9	45
8,000	334	361	−34.1		283	369	−28.9		337	356	−36.9		325	358	−37.8		340	359	−37.2	51	284	365	−30.9	
9,000	322	312	−41.1		277	320	−36.2		330	307	−43.3		319	309	−44.7		332	309	−44.3		279	316	−37.9	
10,000	315	269	−47.3		269	276	−42.8		318	264	−48.6		313	266	−50.7		323	266	−50.7		270	275	−43.9	
11,000	306	231	−51.7		248	238	−48.5		312	227	−52.0		307	228	−54.5		314	228	−54.8					
12,000	293	198	−54.0		233	204	−53.4		298	194	−54.0		296	195	−55.4		302	195	−55.7					
13,000	275	169	−55.5		205	174	−57.1		286	166	−55.2		284	167	−55.0		289	167	−54.9					
14,000	259	144	−56.5		173	149	−60.2		258	142	−56.3		268	143	−55.1		274	142	−54.8					
15,000	245	123	−57.1		142	127	−62.8		228	121	−56.8		248	122	−55.4		257	122	−55.2					
16,000	223	105	−57.6		122	108	−65.4		192	103	−57.2		218	105	−56.2		218	104	−55.7					
17,000	175	90	−57.8						132	88	−57.0		170	89	−56.5		160	89	−56.0					

See footnotes at end of table.

TABLE 1. *Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during year 1941*—Continued

Altitude (meters) M. S. L.	Oakland, Calif. (2 m.)				Oklahoma City, Okla. (391 m.)				Omaha, Nebr. (301 m.)				Pensacola, Fla.[1] (24 m.)				Phoenix, Ariz. (339 m.)				Portland, Maine (20 m.)			
	Number of Observations	Pressure	Temperature	Relative Humidity	Number of Observations	Pressure	Temperature	Relative Humidity	Number of Observations	Pressure	Temperature	Relative Humidity	Number of Observations	Pressure	Temperature	Relative Humidity	Number of Observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	365	1,015	13.5	80	360	971	13.8	80	365	981	9.9	79	300	1,016	19.6	78	364	972	17.8	62	359	1,012	4.7	80
500	364	958	13.0	72	360	958	14.6	76	365	958	10.4	72	300	961	17.8	71	364	955	21.6	48	359	954	6.5	70
1,000	364	902	12.4	59	360	904	13.7	67	365	902	9.4	67	300	907	15.7	65	364	901	19.6	42	359	898	4.3	68
1,500	364	849	10.3	53	360	852	11.8	65	365	849	8.0	62	300	855	13.4	62	364	850	16.2	42	359	844	2.1	67
2,000	364	799	7.6	49	360	802	9.4	62	364	799	5.8	60	300	805	11.1	57	364	801	12.4	44	359	793	0	65
2,500	364	752	4.8	45	360	755	6.8	57	364	751	3.3	58	300	758	8.6	54	364	754	8.8	45	358	745	−2.2	63
3,000	364	707	2.0	42	359	710	3.9	55	364	706	.7	57	299	713	6.1	51	364	709	5.3	46	358	699	−4.5	61
4,000	364	624	−4.1	39	355	627	−2.0	51	356	623	−5.2	53	292	631	.7	48	359	627	−1.1	43	355	615	−9.7	58
5,000	364	549	−10.6	37	348	552	−8.2	47	351	548	−11.3	48	275	556	−5.2	48	356	553	−7.5	40	350	540	−15.6	54
6,000	361	481	−17.6	37	344	485	−14.7	44	346	480	−17.9	45	232	488	−12.7	46	352	485	−14.3	38	346	472	−22.0	51
7,000	358	420	−24.9	36	337	424	−21.6	41	332	419	−25.0	42	223	427	−19.5	47	345	425	−21.4	36	339	411	−29.0	50
8,000	354	366	−32.2	36	329	369	−28.8	39	327	364	−32.3	40	178	372	−26.7	46	342	370	−28.7	35	332	357	−35.9	----
9,000	350	316	−39.4	----	319	320	−35.8	----	315	316	−39.4	----	166	323	−33.9	----	320	321	−35.9	----	322	308	−42.4	----
10,000	342	273	−46.0	----	313	277	−42.5	----	303	272	−45.7	----	147	280	−41.3	----	324	278	−42.9	----	313	265	−47.8	----
11,000	330	234	−51.3	----	302	238	−48.6	----	291	234	−50.7	----	118	241	−48.6	----	315	239	−48.1	----	307	228	−51.4	----
12,000	321	201	−54.5	----	295	204	−53.6	----	277	200	−54.1	----	96	206	−56.0	----	305	205	−52.3	----	296	195	−53.7	----
13,000	313	171	−56.2	----	287	175	−57.4	----	261	171	−56.5	----	----	----	----	----	297	175	−55.7	----	279	167	−55.4	----
14,000	302	146	−57.6	----	277	149	−60.4	----	248	146	−57.6	----	----	----	----	----	289	150	−58.8	----	257	142	−56.6	----
15,000	284	125	−59.0	----	257	126	−62.8	----	230	124	−59.6	----	----	----	----	----	270	127	−61.6	----	227	122	−57.9	----
16,000	261	106	−60.3	----	241	108	−64.4	----	199	106	−60.6	----	----	----	----	----	251	108	−63.8	----	180	104	−58.3	----
17,000	228	90	−60.5	----	202	91	64.6	----	169	90	−60.5	----	----	----	----	----	231	92	−64.2	----	124	89	−57.8	----
18,000	175	77	−60.0	----	----	----	----	----	----	----	----	----	----	----	----	----	184	78	−63.2	----	----	----	----	----

NOTES.—All data are based on observations during 12 months except at Atlanta for which only 11-months data were available, no observations having been made during January.

At some stations data were missing during 1 or 2 months at higher levels. Data were not published for any level where observations were missing for more than one month in the same season or more than 2 months during the year.

Data only for stations in Continental United States are published in this table. Data for other stations will be published in a later issue.

[1] Navy stations.
[2] Airplane observations.

TABLE 2.—*Free-air resultant winds based on pilot balloon observations made near 5 p. m. (75th meridian time) during year 1941. Directions given in degrees from North (N=360°, E=90°, S=180°, W=270°) velocities in meters per second*

Altitude (meters) m. s. l.	Abilene, Tex. (537 m.)			Albuquerque, N. Mex. (1,630 m.)			Atlanta, Ga. (299 m.)			Billings, Mont. (1,095 m.)			Bismarck, N. Dak. (512 m.)			Boise, Idaho (866 m.)			Brownsville, Tex. (7 m.)			Buffalo, N. Y. (220 m.)			Burlington, Vt. (132 m.)			Charleston, S. C. (17 m.)			Chicago, Ill. (192 m.)			Cincinnati, Ohio (152 m.)			Denver, Colo. (1,627 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	351	183	2.1	333	230	1.4	347	280	1.0	347	276	1.1	349	283	1.1	348	315	1.8	345	120	3.6	355	259	3.4	353	277	0.7	356	170	0.9	340	266	1.3	360	262	1.0	353	56	0.8
500	----	----	----	----	----	----	347	282	1.4	----	----	----	----	----	----	----	----	----	343	126	4.4	355	256	5.0	353	265	2.7	356	200	1.6	339	247	2.0	360	252	2.5	----	----	----
1,000	350	183	3.0	----	----	----	342	272	1.7	----	----	----	347	288	2.1	348	313	1.6	283	147	3.1	311	258	6.5	332	279	5.1	343	248	2.3	310	252	4.0	334	249	3.9	----	----	----
1,500	330	201	3.6	----	----	----	334	277	2.6	347	266	2.3	319	281	3.4	348	282	1.0	248	170	2.3	272	270	6.9	303	287	6.8	330	267	4.0	271	259	5.7	315	260	5.3	----	----	----
2,000	311	222	4.2	333	228	2.3	307	284	4.0	342	277	3.1	281	277	4.9	345	250	1.6	210	186	2.3	233	278	7.8	253	294	8.0	308	269	5.3	242	267	6.7	286	270	6.6	352	42	.9
2,500	287	241	5.0	330	249	3.0	294	287	5.2	332	275	4.3	251	279	6.7	322	246	3.1	190	201	2.1	----	----	----	201	302	8.8	294	269	6.1	227	274	7.6	253	276	7.9	339	338	.5
3,000	268	253	6.0	321	257	4.2	276	285	5.8	300	275	6.0	236	280	8.5	304	250	3.9	160	227	1.8	----	----	----	----	----	----	273	270	6.8	212	279	8.9	236	281	8.9	323	279	2.2
4,000	247	265	8.0	279	272	6.9	253	282	8.2	250	276	7.8	205	284	11.5	268	251	5.2	142	257	3.0	----	----	----	----	----	----	210	267	7.5	171	287	10.0	----	----	----	301	282	5.4
5,000	217	270	9.8	252	270	9.4	222	284	10.2	216	278	9.6	189	283	13.5	235	258	6.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	260	282	8.2
6,000	198	272	11.0	225	270	10.4	201	285	11.9	172	273	10.1	167	283	16.1	200	265	6.9	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	225	280	9.6
8,000	----	----	----	176	275	14.8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

TABLE 2.—*Free-air resultant winds based on pilot balloon observaations made near 5 p. m. (75th meridian time) during year 1941. Directions given in degrees from North (N=360°, E=90°, S=180°, W=270°) velocities in meters per second*—Continued

Altitude (meters) m. s. l.	El Paso, Tex. (1,196 m.)			Ely, Nev. (1,910 m.)			Grand Junction, Colo. (1,413 m.)			Greensboro, N. C. (271 m.)			Havre, Mont. (767 m.)			Jacksonville, Fla. (14 m.)			Las Vegas, Nev. (570 m.)			Little Rock, Ark. (79 m.)			Medford, Oreg. (410 m.)			Miami, Fla. (10 m.)			Minneapolis, Minn. (265 m.)			Mobile, Ala. (8 m.)			Nashville, Tenn. (194 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	363	241	1.2	360	208	1.5	359	293	0.9	342	261	1.2	341	260	1.3	350	87	1.4	363	146	1.2	340	184	0.6	339	314	0.9	359	92	2.2	351	245	1.2	346	175	1.1	355	253	0.9
500										342	257	2.1				346	140	0.9				340	213	1.4	339	313	1.0	359	102	2.8	351	234	1.8	346	180	1.1	355	240	1.6
1,000										339	261	3.1	341	257	2.8	332	232	1.7	363	159	1.3	322	227	2.4	336	221	0.6	350	108	1.4	313	244	2.9	328	248	.3	342	246	2.7
1,500	362	237	1.5							337	271	4.4	338	264	4.7	319	252	3.1	362	186	1.6	308	247	3.2	332	208	1.8	332	195	2.2	291	256	4.7	314	302	1.2	326	254	3.3
2,000	360	244	2.2	360	207	1.8	359	280	1.3	327	283	6.3	325	268	5.8	297	264	4.2	357	208	2.5	294	255	4.1	315	206	3.0	305	270	1.1	241	270	6.2	285	291	2.7	297	269	4.5
2,500	351	252	3.5	360	216	2.4	350	243	2.0	313	286	7.8	307	272	6.6	287	271	5.0	349	224	3.0	270	262	5.1	286	212	3.4	289	262	2.0	209	280	7.0	264	288	4.1	275	277	5.7
3,000	333	258	5.0	348	227	2.8	343	239	3.4	294	287	9.2	282	274	7.3	277	272	6.2	340	236	3.6	247	272	6.0	272	226	3.3	280	266	2.4	185	287	8.3	238	285	5.4	251	279	6.5
4,000	301	262	7.7	300	240	4.5	294	248	4.5	267	287	11.4	216	276	8.4	238	272	7.7	318	251	5.4	202	279	7.5	233	250	3.3	252	269	3.7	135	293	13.0	206	277	7.5	182	284	7.4
5,000	244	265	9.5	249	247	6.9	243	262	5.9	233	284	13.2	187	277	9.4	213	278	9.0	291	202	6.4							232	268	4.9				148	281	9.2			
6,000	207	268	11.9	207	261	7.7	192	273	7.6	219	285	15.7	127	277	9.6	198	279	10.5	282	268	8.9							216	270	6.1									
8,000				154	267	11.2													232	279	12.1							148	281	6.8									
10,000																			187	278	15.0																		

Altitude (meters) m. s. l.	New York, N. Y. (15 m.)			Oakland, Calif. (8 m.)			Oklahoma City, Okla. (402 m.)			Omaha, Nebr. (306 m.)			Phoenix, Ariz. (338 m.)			Rapid City, S. Dak. (982 m.)			St. Louis, Mo. (181 m.)			San Antonio, Tex. (180 m.)			San Diego, Calif. (15 m.)			Sault Ste. Marie, Mich. (230 m.)			Seattle, Wash. (12 m.)			Spokane, Wash. (603 m.)			Washington, D. C. (24 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
Surface	341	279	2.5	354	254	3.3	328	183	2.1	342	215	1.1	365	247	0.8	345	352	1.8	340	239	0.9	352	107	2.1	350	270	3.3	307	287	2.4	338	243	1.4	334	213	1.2	349	269	1.9
500	340	278	4.6	353	257	2.1	328	182	2.5	341	217	1.6	365	241	1.0				340	246	2.0	352	117	2.7	350	274	2.5	307	286	3.1	338	206	1.8				349	273	3.2
1,000	329	288	6.4	326	258	1.9	322	193	3.4	326	235	2.6	365	227	1.3	345	350	1.8	322	247	3.4	329	140	2.4	319	249	.8	283	286	4.0	315	205	3.0	334	212	2.1	332	275	4.6
1,500	303	295	7.6	306	250	1.9	307	222	4.1	299	246	4.0	363	212	2.0	345	310	2.5	303	256	4.6	307	170	2.1	310	250	.8	241	290	4.4	280	207	3.7	311	219	3.0	311	286	6.6
2,000	248	298	8.7	292	250	2.0	291	241	4.6	265	258	5.4	354	214	2.6	324	286	3.3	280	265	5.9	269	212	2.5	291	262	1.2	204	300	4.8	250	206	3.8	285	227	3.6	288	291	8.5
2,500	204	300	9.6	281	261	2.0	273	255	5.6	241	271	6.7	344	223	3.3	297	283	5.4	257	270	6.9	237	237	3.3	281	261	2.4	186	305	5.9	230	211	4.0	248	238	4.1	260	303	9.9
3,000				269	286	2.6	252	262	6.5	222	279	7.7	340	233	4.0	281	281	7.1	234	276	8.1	200	255	4.2	261	267	3.4				201	216	3.9	228	250	4.4	238	303	11.1
4,000				239	307	4.2	216	270	8.4	201	286	9.9	312	246	5.4	254	279	9.2	218	280	10.1				306	265	5.3				153	238	4.7	167	255	4.9	207	303	13.1
5,000							188	273	9.9	183	290	11.1	291	257	7.0	226	281	10.6	190	283	11.5																		
6,000										147	292	12.7	264	261	8.4	191	282	12.1	164	284	13.0																		
8,000													207	268	11.8																								

TABLE 3.—*Maximum free-air wind velocities, (m. p. s.), for different sections of the United States based on pilot balloon observations during the year 1941*

Section	Surface to 2,500 meters (m. s. l.)					Between 2,500 and 5,000 meters (m. s. l.)					Above 5,000 meters (m. s. l.)				
	Maximum velocity	Direction	Altitude (m) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station
Northeast [1]	48.0	WNW	2,500	Nov. 27	Boston, Mass.	61.0	WNW	2,980	Nov. 27	Boston, Mass.	72.6	NW	11,220	Aug. 10	Buffalo, N. Y.
East-Central [2]	44.2	WNW	2,050	Feb. 17	Louisville, Ky.	68.0	WNW	3,520	Feb. 18	Norfolk, Va.	85.0	SSW	7,650	Nov. 8	Greensboro, N. C.
Southeast [3]	37.7	NW	2,320	Feb. 18	Spartanburg, S. C.	48.4	W	5,000	Jan. 4	Jacksonville, Fla.	73.8	WNW	9,580	Mar. 12	Jacksonville, Fla.
North-Central [4]	50.4	SW	1,570	Dec. 3	Marquette, Mich.	63.2	WSW	3,170	Oct. 7	Muskegon, Mich.	78.0	N	8,740	Dec. 5	Fargo, N. Dak.
Central [5]	57.6	SSW	1,100	Apr. 13	Des Moines, Iowa.	68.8	NW	4,420	Jan. 30	Moline, Ill.	73.6	W	12,470	Dec. 6	Wichita, Kan.
South-Central [6]	42.8	S	1,900	May 19	Amarillo, Tex.	53.6	S	4,210	Apr. 19	Dallas, Tex.	84.0	WSW	9,970	Dec. 5	Oklahoma City, Okla.
Northwest [7]	43.5	W	2,300	Nov. 24	Harve, Mont.	61.5	WSW	4,280	June 25	Havre, Mont.	77.0	N	10,220	Oct. 2	Great Falls, Mont.
West-Central [8]	48.6	SSW	2,080	Sept. 19	Modena, Utah.	56.6	SSW	3,560	June 26	Modena, Utah.	79.2	NW	9,920	Feb. 9	Pueblo, Colo.
Southwest [9]	53.0	SSW	2,500	Mar. 31	Phoenix, Ariz.	80.0	WNW	5,000	Feb. 12	Winslow, Ariz.	91.6	NNW	9,820	Feb. 9	Albuquerque, N. Mex.

[1] Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, and Northern Ohio.
[2] Delaware, Maryland, Virginia, West Virginia, Southern Ohio, Kentucky, Eastern Tennessee and North Carolina.
[3] South Carolina, Georgia, Florida and Alabama.
[4] Michigan, Wisconsin, Minnesota, North Dakota and South Dakota.
[5] Indiana, Illinois, Iowa, Nebraska, Kansas and Missouri.
[6] Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except El Paso), and Western Tennessee.
[7] Montana, Idaho, Washington and Oregon.
[8] Wyoming, Colorado, Utah, Northern Nevada and Northern California.
[9] Southern California, Southern Nevada, Arizona, New Mexico, and extreme West Texas.

TABLE 4.—*Monthly mean heights of freezing temperatures (0° C.) during year 1941, from mean monthly values based on airplane and radiosonde observations*

Stations	Elevation in meters (m. s. l.)	January		February		March		April		May		June		July		August		September		October		November		December	
		Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)
Albuquerque, N. Mex.	1,620					17	28	29	28	30	40	30	44	29	47	30	48	28	46	30	38	30	34	31	27
Anchorage, Alaska	42	31	(1)	28	(1)	31	5	30	9	30	12	30	23	28	22	31	28	31	19	31	8	30	(1)	31	(1)
Atlanta, Ga.	300					31	22	30	34	30	40	29	46	31	48	29	49	30	48	31	46	30	33	31	35
Barrow, Alaska	6	31	(1)	28	(1)	31	(1)	30	(1)	31	(1)	30	17	31	18	31	22	31	(1)	30	(1)	30	(1)	(2)	
Bethel, Alaska	7	31	(1)	27	(1)	31	(1)	28	3	31	8	30	22	31	24	30	29	29	22	31	5	24	(1)	(2)	
Bismarck, N. Dak.	505	31	(1)	27	(1)	30	(1)	30	21	30	32	29	39	31	46	30	43	30	35	31	28	30	17	31	(1)
Boise, Idaho	864									30	33	29	37	25	44	29	41	29	34	29	29	28	26	28	10
Brownsville, Tex.	6	31	37	27	38	31	39	28	44	31	45	29	50	31	49	31	49	31	51	31	49	30	42	31	42
Buffalo, N. Y.	221	15	(1)	28	(1)	31	(1)	30	23	31	28	30	39	31	41	31	39	29	43	30	31	29	17	30	5
Charleston, S. C.	14	31	26	28	22	31	22	30	34	30	39	29	44	29	47	31	48	31	48	30	47	30	36	30	35
Denver, Colo.	1,616	31	(1)	28	(2)	30	20	30	26	27	38	30	42	28	47	28	47	29	43	30	34	28	30	31	(2)
Detroit, Mich.	194															30	43	31	44	30	36	30	20	31	6
El Paso, Tex.	1,193	31	28	28	30	30	30	29	35	31	42	30	45	28	48	30	48	30	48	29	42	25	37	31	32
Ely, Nev.	1,908	31	(1)	28	(2)	31	(2)	30	23	31	36	30	40	31	47	29	44	31	38	31	31	30	30	31	(1)
Fairbanks, Alaska	156	31	(1)	28	(1)	30	(1)	30	11	31	16	29	25	31	25	31	26	31	15	30	(1)	30	(1)	(2)	
Great Falls, Mont.	1,128	31	(1)	28	(1)	31	17	30	23	30	30	28	37	31	42	31	42	30	29	31	28	29	23	30	(1)
Huntington, W. Va.	172															30	48	29	48	31	39	30	24	31	20
Joliet, Ill.	178	31	(1)	28	(1)	30	(1)	27	24	(3)		(3)		(3)		26	41	28	44	27	36	30	22	30	10
Juneau, Alaska	49	28	(1)	27	3	30	8	28	11	29	15	28	21	26	27	29	28	31	20	27	13	29	4	31	(1)
Ketchikan, Alaska	26	31	7	26	7	29	11	27	14	31	15	30	24	30	30	31	31	30	21	26	17	28	10	28	(1)
Lake Charles, La.	5															28	50	27	50	30	48	28	37	31	38
Lakehurst, N. J.	39	31	(1)	26	(1)	30	(1)	30	24	31	28	30	40	29	45	29	42	29	44	31	37	29	21	25	(2)
Medford, Oreg.	401	31	20	27	21	30	24	29	22	31	28	29	31	31	46	31	39	31	34	31	31	30	29	31	17
Miami, Fla.	4	30	37	27	38	31	38	27	42	31	44	30	45	31	47	30	47	31	48	30	48	30	43	30	43
Nashville, Tenn.	180	31	18	28	5	31	13	30	32	31	37	30	43	29	47	30	49	31	50	29	44	28	28	30	28
Nome, Alaska	14	31	(1)	28	(1)	31	(1)	30	(1)	30	7	28	25	30	23	26	31	29	17	30	2	30	(1)	(2)	
Norfolk, Va.	10	24	12	17	(1)	23	12	21	30	28	35	13	42	20	46	25	45	23	45	18	42	24	31	21	27
Oakland, Calif.	2	31	24	28	24	31	26	30	24	31	35	30	38	31	46	31	43	31	42	31	36	30	35	30	23
Oklahoma City, Okla.	391	31	24	23	25	30	23	30	32	31	40	29	44	31	47	31	48	29	49	27	42	30	32	31	30
Omaha, Nebr.	301	31	(1)	28	(1)	31	7	30	27	31	35	27	41	31	46	30	47	30	44	27	37	29	25	31	17
Pearl Harbor, T. H.	6													29	51	15	47	21	46	26	46	24	49	(2)	
Pensacola, Fla.	24	27	32	28	28	31	30	27	39	26	45	28	46	20	46			19	47	22	48			22	37
Phoenix, Ariz.	339	31	22	28	29	31	28	30	28	30	40	30	44	31	51	27	51	31	49	31	40	29	38	29	31
Portland, Maine	20	30	(1)	28	(1)	31	(1)	30	20	27	24	30	35	31	40	31	34	31	41	30	25	30	12	29	(1)
St. Louis, Mo.	171	18	3	28	(1)	31	8	30	27	29	35	29	42	31	46	30	47	30	46	30	41	29	26	29	22
St. Paul, Minn.	225	30	(1)	28	(1)	31	(1)	30	24	31	34	29	42	31	45	29	42	29	40	31	32	29	15	31	(1)
San Antonio, Tex.	174							30	41	31	44	29	48	31	50	29	51	30	52	31	48	30	40	31	39
San Diego, Calif.	19	30	28	24	30	27	28	27	27	29	41	29	45	30	47	30	49	30	49	28	40	27	37	31	32
San Juan, P. R.	15			27	49	28	50	26	47	30	49	28	47	30	48	27	50	30	49	29	48	29	48	27	47
Sault Ste Marie, Mich.	221	31	(1)	28	(1)	31	(1)	30	19	31	27	30	37	31	40	31	35	30	36	31	25	30	5	31	(1)
Seattle, Wash.	27	17	15	28	18	31	19	28	20	30	22	30	27	30	39	31	35	29	25	31	25	30	20	20	8
Spokane, Wash.	598	31	(2)	27	15	31	18	30	22	31	27	30	33	31	41	29	38	30	26	31	20	29	20	31	(1)
Swan Island, West Indies	10	30	47	27	49	31	50	30	50	28	50	30	50	31	49	30	48	30	50	30	52	29	51	31	51
Washington, D. C.	24	24	(1)	21	(1)	31	8	29	28	29	31	30	42	26	47	26	46	31	48	31	40	30	27	29	18

[1] Surface.
[2] Mean monthly temperature at surface was 0° C. or lower, above which was an inversion with mean temperatures above freezing.
[3] Data not yet received.

At Coco Solo and St. Thomas the level of average freezing conditions was not reached.

RIVER STAGES AND FLOODS

By BENNETT SWENSON

Precipitation was above normal during December 1941 in the Atlantic Slope States from Pennsylvania southward, the East Gulf States, the Central Plains States and all States west of the Rocky Mountains. Most of the Ohio Basin continued dry and the extreme upper and lower Mississippi basins and Texas were below normal; New England and New York were slightly below normal.

Floods mostly minor, occurred principally in portions of the Southeastern States and in the Pacific slope drainage.

Atlantic Slope drainage.—General heavy rains over the entire watershed of the Susquehanna River on December 23–24, produced the highest flows in the basin since the first half of April, except for the Juniata River where the previous highs were recorded in June. Stages near the flood level were reached in portions of the upper basin and a stage of 13 feet, 1 foot above flood stage, was reached in the Tioughnioga River at Whitney Point, N. Y., on the 25th.

Minor flooding occurred in portions of the Santee, Savannah, Ogeechee, and Altamaha River systems near the end of the month. Two periods of heavy rain occurred over this area during the month. The first period of rain occurred on the 3d and 4th in connection with a disturbance over the East Gulf, and caused only slight rises in the river stages but served to bring water levels above the low stages which had existed previously. On the early morning of the 23d a well-developed LOW was centered over southwestern Missouri with a ridge of high pressure along the Atlantic coast. The steep east-west pressure gradient between the advancing low-pressure system and the high-pressure ridge produced a strong influx of warm moist tropical air east of the Mississippi River and resulted in unusually heavy rains over the Southeastern States. The rivers rose rapidly, reaching flood stage, or slightly higher, at a few points. At Haw-

kinsville, Ga., in the Altamaha River basin, 7.60 inches of rain fell on the 22–23d and caused an unusual rise of 11.3 feet in the river at that point on the 24th.

No appreciable damage occurred in connection with these floods; the benefits gained from the increase in water supply probably more than offset any damage or inconvenience caused.

East Gulf of Mexico drainage.—Heavy rains occurred over the entire Tombigbee and Black Warrior watersheds on December 22–23, ranging from 1.25 to 2.75 inches over the Black Warrior and upper Tombigbee basins and from 3 to 6.25 inches over the lower Tombigbee basin. The stages rose rapidly, and rains again on December 25–26 caused still further rises. Flood stage was exceeded, however, only at Lock No. 3, Whitfield, Ala., on the lower Tombigbee River, where a stage of 40.6 feet was reached on December 28th.

Flood stage was also exceeded slightly at a few points in the Flint, Apalachicola and Pearl River basins, but resulted in no appreciable damage.

Mississippi system.—Stages were low or moderately low generally during the month and overflows were reported only in the Grand River at Chillicothe, Mo., the North Canadian River at Yukon, Okla., and the Sulphur River at Ringo Crossing, Tex. In the Grand River, heavy rains over the basin on December 22–23, caused a rise of over 18 feet in 24 hours at Chillicothe.

Pacific Slope drainage.—Precipitation was much above normal for the month and light to moderate floods occurred principally in the Sacramento, Willamette and and Eel River basins.

The first general rise of importance in the Sacramento River system for the present rainfall season occurred near the middle of the month in connection with an intensive rainstorm that began over the upper drainage area on December 14, and continued at intervals until the 17th. The antecedent soil moisture was fairly high due to nearly normal rainfall during the fall season.

Although no flood stage was actually reached at any reporting river station, some overflow of low ground areas occurred especially in Tehama County. Large quantitites of water were diverted at all stationary weirs into the bypasses; the maximum overflow depth at Fremont Weir into Yolo Bypass was 2.1 feet on the 20th. Little Holland Tract (2,700 acres) and Prospect Island (2,500 acres) in Yolo Bypass were flooded. As these islands had not been planted to crops this year, no tangible losses were reported.

Overflows on three separate occasions occurred during the month in the Eel River at Fernbridge, Calif. The first flood, on December 3, developed during the night and was of such slight intensity and short duration that no damage or losss resulted. The floods of December 16–17 and 18–19 were the most destructive since the flood of February 1940. The highest stage reached at Fernbridge was 21.3 feet on the 18th. The damage to flood protection works and roads, and the cost of cleaning up and removing debris is estimated at $16,000.

Floods occurred in the Willamette River basin from two storm periods, December 1–3 and 15–19. Damage from these floods was slight.

FLOOD-STAGE REPORT, DECEMBER 1941

[All dates in December unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE	*Feet*			*Feet*	
Tioughnioga: Whitney Point, N. Y.	12	24	25	13.0	25
Saluda: Pelzer, S. C.	6	25	25	6.0	25
Broad: Blairs, S. C.	14	24	24	14.2	24
Santee: Rimini, S. C.	12	26	29	12.6	28
Savannah:					
Butler Creek, Ga.	21	25	26	21.5	25
Clyo, Ga.	11	29	(1)	12.1	31
Ogeechee:					
Midville, Ga.	6	26	30	6.2	27
Dover, Ga.	7	28	(1)	8.7	30
Ocmulgee:					
Macon, Ga.	18	24	24	18.2	24
Abbeville, Ga.	11	25	(1)	13.3	27
Oconee:					
Milledgeville, Ga.	20	24	27	23.0	24
Mt. Vernon, Ga.	16	28	(1)	16.8	31
Altamaha: Charlotte, Ga.	12	28	(1)	15.7	31
EAST GULF OF MEXICO DRAINAGE					
Flint: Albany, Ga.	20	26	(1)	21.8	29
Apalachicola: Blountstown, Fla.	15	26	(1)	19.4	30
Tombigbee: Lock No. 3, Whitfield, Ala.	33	25	31	40.6	28
Pearl: Pearl River, La.	12	28	(1)	14.1	30
MISSISSIPPI SYSTEM					
Upper Mississippi Basin					
Mississippi: Louisiana, Mo.	12	4	25	[3] 12.3	24
		27	28	[3] 12.1	27
Missouri Basin					
Grand: Chillicothe, Mo.	18	24	26	23.5	24
Arkansas Basin					
North Canadian: Yukon, Okla.	8	(2)	(1)	9.8	6
Red Basin					
Sulphur: Ringo Crossing, Tex.	20	3	4	[4] 22.0	3
		12	16	[4] 25.5	13
		23	23	[4] 20.0	23
WEST GULF OF MEXICO DRAINAGE					
East Fork Trinity: Rockwall, Tex.	10	3	3	10.7	3
		12	15	11.5	13
GULF OF CALIFORNIA DRAINAGE					
Colorado Basin					
Gila: Kelvin, Ariz.	5	12	12	5.8	12
PACIFIC SLOPE DRAINAGE					
Eel Basin					
Eel: Fernbridge, Calif.	17.5	3	3	18.0	3
		16	17	19.2	16
		18	19	21.3	18
Columbia Basin					
South Yamhill:					
Willamina, Oreg.	8	19	20	10.9	19
Whiteson, Oreg.	38	19	21	41.6	20
McKenzie: Leaburg, Oreg.	12	18	19	13.8	18
Long Tom: Monroe, Oreg.	10	3	5	12.1	4
		16	21	12.0	20
		23	(1)	10.9	24–25
Santiam: Jefferson, Oreg.	13	3	4	17.2	3
		19	21	16.2	20
Luckiamute: Suver, Oreg.	25	19	21	27.7	20
Willamette:					
Harrisburg, Oreg.	10	3	5	11.6	3
		17	17	10.0	17
		18	22	14.0	19
Albany, Oreg.	20	21	21	20.2	21
Oregon City, Oreg.	12	21	23	13.1	22

[1] Continued into following month.
[2] Due to manipulation of Dam No. 24.
[3] Continued from preceding month.
[4] Gage out; stages estimated.

CLIMATOLOGICAL DATA

CONDENSED CLIMATOLOGICAL SUMMARY OF TEMPERATURE AND PRECIPITATION BY SECTIONS

[For description of tables and charts, see REVIEW, January, p. 31]

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course, the number of such records is smaller than the total number of stations.

Section	Temperature								Precipitation					
			Monthly extremes								Greatest monthly		Least monthly	
	Section average	Departure from the normal	Station	Highest	Date	Station	Lowest	Date	Section average	Departure from the normal	Station	Amount	Station	Amount
	°F.	°F.		°F.			°F.		In.	In.		In.		In.
Alabama	50.4	+2.7	Highland Home	81	[1] 1	Cordova	19	15	7.32	+1.91	Whatley	13.61	Bishop	2.28
Arizona	43.6	+.8	3 stations	84	[1] 2	Fraziers Well	−8	25	1.96	+.66	Sierra Ancha	4.78	Wupatki	.32
Arkansas	44.7	+1.8	Camden	80	[1] 1	Gilbert	14	[1] 7	3.67	−.53	White Cliffs	6.62	Portland	1.09
California	46.0	+.2	Sierra Madre	88	7	Ellery Lake	−10	27	8.15	+4.24	West Branch	30.76	Mecca	.31
Colorado	28.5	+2.7	Fort Morgan	84	2	Taylor Park	−26	26	.87	−.03	Cumbres	5.80	Utleyville	T
Florida	63.3	+3.5	3 stations	90	[1] 5	Mason	23	15	4.01	+1.20	Glen St. Mary	10.59	2 stations	.39
Georgia	50.2	+2.4	Moultrie	82	2	Blairsville	14	14	7.28	+3.00	Hawkinsville	13.29	Quitman	3.20
Idaho	29.1	+2.6	Emmett	67	3	Obsidian (near)	−27	27	3.37	+1.30	Roland	10.92	Mud Lake	.36
Illinois	37.6	+6.4	Fairfield	71	1	3 stations	5	[1] 10	1.68	−.43	Anna	4.77	Henry	.74
Indiana	37.8	+5.4	Huntingburg	73	1	Bluffton	4	15	1.98	−.79	Johnson	3.56	Frankfort	.75
Iowa	32.1	+7.8	Ottumwa	67	20	Decorah	−15	29	1.92	+.74	Glenwood	3.65	Akron	.47
Kansas	37.8	+4.6	Ashland	77	4	Oberlin	−16	28	1.09	+.25	Chapman	2.49	Lakin (near)	.11
Kentucky	42.5	+4.6	Danville	72	23	Farmers	11	11	2.80	−1.03	Bowling Green	5.08	Murray	1.41
Louisiana	54.7	+2.2	Bogalusa	85	5	3 stations	24	[1] 6	4.04	−1.30	Port Eads	12.16	Hackberry (near)	1.67
Maryland-Delaware	39.7	+4.2	2 stations	71	4	2 stations	6	11	3.48	+.31	State Sanatorium, Md.	4.96	Luke, Md	1.86
Michigan	31.3	+6.3	Bay City	68	4	Garnet	−15	29	1.78	−.27	Detour	4.68	Harrisville	.66
Minnesota	22.8	+6.9	Canby	72	3	Big Falls	−21	31	.61	−.15	Pigeon River Bridge	1.91	Argyle	.11
Mississippi	51.4	+3.0	Leaksville	81	5	Kasciusko	20	29	4.88	−.42	Woodville	10.99	Greenville	1.56
Missouri	39.6	+5.3	Doniphan	72	20	Unionville	3	29	2.21	+.06	Morehouse	5.46	Yarber	.71
Montana	25.9	+2.5	Crow Agency	72	3	Belgrade	−34	31	1.21	+.25	Heron	6.95	Medicine Lake (near)	T
Nebraska	31.3	+4.2	Fort Robinson	75	3	Nenzel (near)	−23	28	1.03	+.34	Lincoln (Univ. Campus).	3.51	Burwell	.28
Nevada	35.1	+4.0	Desert Game Range	74	20	Geyser	−13	25	1.59	+.59	Lewers Ranch	10.76	Mina	.07
New England	29.6	+3.0	Enosburg Falls, Vt.	72	5	2 stations	−25	[1] 21	3.21	−.12	Pinkham Notch, N. H.	5.64	Gilman, Vt	.89
New Jersey	37.2	+3.4	Newton	70	24	Layton	0	22	3.70	+.15	Charlotteburg	4.98	Cape May	2.24
New Mexico	36.5	+2.3	2 stations	76	[1] 3	Gavilan	−26	26	.74	+.04	Chama	4.22	Obar	.00
New York	30.4	+3.5	Wiscoy	71	4	McKeever	−26	21	2.95	+.02	Scarsdale	5.46	Chazy	1.15
North Carolina	45.2	+2.5	Mount Gilead	79	1	Banners Elk	6	15	4.42	+.62	Rock House	9.58	Hot Springs	1.44
North Dakota	22.5	+9.2	Hankinson	68	3	3 stations	−20	[1] 10	.15	−.33	Towner	.70	Tioga	T
Ohio	37.4	+5.5	Wooster No. 1	71	4	Paulding	−1	15	1.89	−.83	Dayton No. 2	3.49	Lock No. 14	.97
Oklahoma	44.0	+3.9	2 stations	79	[1] 3	Guymon	8	31	1.51	−.15	Smithville	4.44	Kenton	.11
Oregon	35.7	+2.1	Echo	72	2	Olive Lake	−24	31	5.99	+2.12	Valsetz	26.36	Andrews	.66
Pennsylvania	35.6	+4.1	Uniontown	76	4	Coudersport	−8	21	3.09	+.01	Gordon	5.62	New Castle	1.05
South Carolina	49.1	+2.3	2 stations	79	1	Cherokee (near)	17	15	6.95	+3.37	Charleston Airport	11.08	Society Hill	3.22
South Dakota	28.8	+6.8	do	78	[1] 3	Ardmore	−21	28	.32	−.21	Spearfish	1.16	Ipswich	.00
Tennessee	44.4	+3.5	do	75	[1] 3	2 stations	11	15	3.15	−1.33	Dunlap	6.12	Newport	1.21
Texas	50.9	+2.0	do	89	[1] 18	Dumas	2	31	1.72	−.56	Port Arthur	5.66	Lamesa	.00
Utah	31.0	+4.0	Toquerville	71	2	Ibapah	−11	27	1.91	+.80	Timpanogos Summit	8.18	Callao	.02
Virginia	42.1	+3.9	Callaville	78	3	Mountain Lake	5	30	3.47	+.42	Balcony Falls	6.38	Moores Creek Dam	1.28
Washington	35.7	+2.9	2 stations	68	2	Stockdill Ranch	−15	31	6.39	+1.03	Wind River	24.63	Hanford	.40
West Virginia	39.3	+4.5	3 stations	74	[1] 3	Seneca State Forest	2	30	2.24	−1.01	Kearneysville	4.10	McNeill	1.10
Wisconsin	28.1	+7.4	Sparta	64	5	Blair	−13	29	1.41	+.10	Stevens Point	2.51	Ladysmith	.42
Wyoming	25.6	+3.5	2 stations	77	3	Hunters Station	−27	31	.99	+.25	Bechler River	8.90	Clark	.01
Alaska (November)	11.9	−2.1	Annette Island	64	16	3 stations	−50	27	2.91	+.16	Little Port Walter	28.05	Crooked Creek	.13
Hawaii	72.2	+.8	Waianae (Oahu)	91	[1] 20	Haleakala (Maui)	30	30	3.90	−3.79	Hakalau (Mauka)	15.24	3 stations	.00
Puerto Rico	75.9	+1.7	2 stations	94	[1] 9	Guineo Reservoir	54	31	3.79	−.79	Rio Blanco	12.29	Potala	.10

[1] Other dates also.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max.+mean min.÷2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	*° F.*	*° F.*	*°F.*		*°F.*	*° F.*		*°F.*	*° F.*	*° F.*	*° F.*	*%*	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*
New England							**30.3**	**+2.3**										**75**	**2.72**	**−0.7**										**6.2**		
Eastport	75	67	85	29.88	29.96	−0.02	28.4	+2.1	49	6	35	−3	21	22	30	27	24	84	1.98	−1.8	11	11.6	nw.	46	e.	14	7	10	14	6.8	6.0	T
Greenville, Maine	1,070	6	41	28.79	30.00	.....	20.0	+1.4	59	5	30	−12	21	10	38	19	16	...	3.30	.....	12	.....	nw.	.....	.....	.....	6	9	16	.....	16.2	8.5
Portland, Maine [1]	103	5	36	29.88	29.99	−.04	29.4	.....	63	4	38	2	21	20	30	25	20	72	2.90	−1.1	9	8.5	nw.	35	se.	24	13	10	8	4.8	1.5	T
Concord [2]	289	54	72	29.69	30.01	−.05	28.3	+1.5	63	4	38	−3	12	18	40	24	20	75	2.66	−.5	9	7.9	nw.	30	nw.	20	6	12	13	5.9	7.4	.5
Burlington [2]	403	11	48	29.58	30.04	−.01	26.0	+1.6	67	5	34	−5	22	18	33	24	20	80	1.43	−.4	11	10.3	s.	34	s.	18	3	8	20	7.7	11.7	T
Northfield	876	12	60	29.05	30.03	−.02	23.8	+3.4	58	5	33	−14	22	14	42	.....	.....	...	2.26	−.2	11	7.6	n.	29	se.	24	4	10	17	7.2	16.6	.5
Boston [1]	124	33	62	29.88	30.01	−.04	35.2	.....	59	4	43	7	21	28	31	31	25	70	3.19	−.3	9	12.1	nw.	36	s.	24	8	10	13	6.3	.2	.1
Nantucket	12	10	63	30.00	30.01	−.04	38.0	+2.2	60	5	44	13	21	32	27	35	32	79	2.58	−1.2	10	11.4	nw.	34	e.	14	7	4	20	7.2	.2	.0
Block Island	26	11	46	30.00	30.03	−.03	38.0	+2.0	57	5	44	13	21	32	29	36	31	74	2.38	−1.4	7	18.8	w.	45	nw.	24	6	15	10	5.8	T	.0
Providence [2]	159	46	60	29.86	30.04	−.02	34.4	+2.8	61	3	43	9	21	26	32	31	26	74	3.37	.0	6	9.1	nw.	39	se.	24	8	11	12	5.8	T	.0
Hartford [1]	159	5	44	29.86	30.05	−.02	33.2	.....	61	4	42	8	21	25	29	30	25	75	3.08	−.9	8	9.3	n.	40	s.	24	5	13	13	6.0	1.0	.0
New Haven [2]	107	74	153	29.94	30.06	−.01	36.0	+3.5	60	5	43	9	21	29	29	31	27	71	4.12	+.1	9	9.1	nw.	33	se.	24	8	14	9	5.4	.5	.0
Middle Atlantic States							**40.6**	**+4.1**										**72**	**3.22**	**−0.1**										**6.1**		
Albany [1]	97	26	40	29.94	30.05	−.03	29.8	.....	57	5	37	1	21	23	32	27	22	75	2.06	−.6	11	10.0	s.	34	n.	20	4	8	19	7.4	6.5	.2
Binghampton	871	57	79	29.12	30.08	−.01	32.8	+4.6	68	4	40	7	21	25	31	30	27	81	2.89	+.6	15	6.5	w.	19	sw.	24	2	8	21	8.3	4.8	1.8
New York	314	415	454	29.72	30.07	−.02	38.2	+3.2	60	5	45	13	21	31	25	34	27	65	4.12	+.5	7	16.9	nw.	63	se.	24	6	14	11	5.7	.4	.0
Harrisburg [1]	374	30	49	29.69	30.10	−.02	37.4	.....	61	3	44	18	22	30	27	33	28	73	3.49	+.5	9	8.5	nw.	34	se.	24	4	10	17	7.3	.4	.0
Philadelphia [2]	114	174	367	29.96	30.09	−.02	39.8	+3.5	63	5	46	18	21	33	24	34	30	73	3.67	+.2	5	12.3	n.	43	s.	24	6	15	10	5.8	.5	.0
Reading	323	47	306	29.74	30.10	.....	37.8	+3.6	62	5	45	16	21	31	26	33	27	65	3.26	−.3	10	12.3	nw.	47	sw.	24	5	12	14	6.5	.7	.0
Scranton	805	72	104	29.21	30.06	−.04	34.4	+3.7	63	4	41	10	21	27	28	.....	.....	...	1.47	−1.6	8	7.4	sw.	31	sw.	24	3	13	15	7.2	.2	T
Atlantic City	52	37	172	30.03	30.08	−.02	41.0	+4.6	63	3	48	18	21	34	22	37	31	70	3.43	−.5	7	15.6	w.	47	se.	24	9	11	11	5.8	T	.0
Trenton	190	89	107	29.88	30.09	.....	37.9	+3.5	63	5	45	16	21	31	26	34	28	67	3.08	−.3	7	8.9	nw.	31	s.	24	7	12	12	6.1	.4	.0
Baltimore [2]	123	100	215	29.97	30.11	−.02	42.5	+5.3	66	5	49	23	21	36	24	36	30	69	3.48	−.1	7	10.3	sw.	41	s.	24	8	11	12	5.8	.1	.0
Washington [2]	112	62	85	30.04	30.11	−.02	41.9	+5.3	66	3	50	24	30	34	28	36	31	69	3.94	+.6	9	7.1	nw.	29	nw.	20	9	11	11	5.4	.2	.0
Cape Henry	18	8	54	30.08	30.10	.....	46.6	+2.9	70	24	53	32	30	40	27	42	38	75	3.25	−.2	8	12.9	n.	40	n.	20	11	11	9	5.1	T	.0
Lynchburg	686	144	184	29.37	30.13	−.01	44.2	+4.7	72	3	54	21	30	34	34	37	31	66	4.34	+1.1	9	7.0	nw.	30	nw.	20	15	6	10	4.9	.0	.0
Norfolk [2]	91	80	125	30.01	30.12	−.01	47.4	+4.3	72	4	55	29	15	40	24	40	37	79	2.87	−.5	8	9.7	n.	31	se.	24	9	10	12	5.5	.0	.0
Richmond [2]	144	11	52	29.95	30.11	−.03	43.9	+4.1	71	5	53	23	15	35	32	36	33	80	2.96	−.3	8	7.6	sw.	26	nw.	20	11	13	7	5.0	.0	.0
South Atlantic States							**50.1**	**+3.3**										**78**	**6.05**	**+2.7**										**5.4**		
Asheville	2,253	89	104	27.74	30.15	−.01	42.7	+4.9	68	1	53	19	15	32	36	36	31	72	3.40	+.2	7	8.7	nw.	34	se.	23	9	11	11	6.0	.0	.0
Charlotte [2]	779	63	86	29.26	30.11	−.05	47.2	+4.2	73	1	56	24	15	38	28	39	35	76	4.82	+1.0	7	6.4	sw.	18	sw.	24	12	10	9	5.2	.0	.0
Greensboro [1]	886	6	56	29.17	30.13	.....	43.5	.....	70	3	54	18	15	32	33	37	33	75	3.02	.....	7	7.6	sw.	38	se.	23	12	8	11	5.3	.0	.0
Hatteras	11	5	50	30.09	30.10	−.03	51.8	+1.7	75	2	58	33	16	46	25	48	46	85	8.82	+4.6	11	13.4	n.	34	n.	6	12	7	12	5.3	.0	.0
Raleigh [1]	376	27	69	29.71	30.12	−.03	46.2	.....	71	5	56	23	15	36	34	40	35	72	4.39	+.8	8	8.4	sw.	29	nw.	4	14	7	10	4.7	T	.0
Wilmington	72	73	107	.....	30.12	−.03	51.6	+2.5	74	2	61	30	30	42	28	.....	.....	78	6.20	+3.4	8	8.1	nw.	28	sw.	4	12	6	13	.....	.0	.0
Charleston [2]	48	11	92	30.05	30.10	−.05	54.4	+2.7	73	1	62	37	15	47	26	47	45	87	10.56	+7.8	11	9.8	n.	25	s.	24	12	5	14	5.7	.0	.0
Columbia, S. C. [2]	347	70	91	29.74	30.12	−.04	50.2	+3.0	74	2	60	29	15	41	29	43	40	80	4.89	+1.9	6	7.5	ne.	24	sw.	24	13	10	8	4.9	.0	.0
Greenville, S. C.	1,039	139	146	.....	.....	.....	47.0	+4.8	70	10	56	25	15	38	29	.....	.....	...	5.15	+.3	7	8.4	ne.	27	ne.	12	13	8	10	4.8	T	.0
Augusta [2]	182	62	77	29.91	30.11	−.05	50.8	+2.7	76	1	61	28	15	41	33	44	39	71	6.71	+3.5	8	5.1	nw.	17	nw.	6	13	6	12	5.3	.0	.0
Savannah [2]	65	73	152	30.04	30.11	−.04	56.2	+3.8	79	3	65	35	30	48	31	48	45	81	4.89	+2.0	9	9.6	nw.	30	nw.	6	12	4	15	5.7	.0	.0
Jacksonville [2]	43	86	110	30.05	30.10	−.04	59.4	+3.1	80	26	68	36	15	51	26	53	51	86	7.71	+4.7	12	7.0	n.	21	w.	6	8	6	17	6.5	.0	.0
Florida Peninsula							**74.2**	**+5.0**										**86**	**3.90**	**+2.1**										**6.8**		
Key West [2]	21	10	64	30.01	30.03	−.05	75.1	+4.8	86	5	80	65	15	71	13	71	69	87	3.46	+1.8	9	9.1	ne.	20	sw.	24	6	13	12	6.1	.0	.0
Miami [2]	25	124	168	30.01	30.04	−.07	73.2	+5.2	85	6	79	56	18	68	21	66	64	87	1.19	−.5	10	9.4	e.	23	e.	21	4	8	19	7.3	.0	.0
Tampa [1]	35	5	61	30.04	30.07	−.05	65.6	.....	82	2	73	45	7	58	30	60	58	85	7.04	+5.0	12	9.7	n.	29	sw.	24	3	14	14	7.1	.0	.0
East Gulf States							**53.3**	**+2.8**										**80**	**6.32**	**+1.4**										**6.2**		
Atlanta [1]	1,173	5	72	28.86	30.11	−.05	47.8	.....	74	1	57	28	29	39	29	41	37	75	6.98	+2.2	9	9.9	nw.	31	nw.	6	10	10	11	5.4	.0	.0
Macon [2]	370	79	87	29.71	30.11	−.05	50.6	+3.1	75	2	61	27	15	40	35	44	40	77	7.88	+3.9	9	6.3	nw.	24	s.	23	10	11	10	5.5	.0	.0
Thomasville	273	49	58	29.82	30.12	−.03	54.6	+2.1	79	2	65	30	15	44	33	.....	.....	...	4.31	.0	10	.....	ne.	.....	.....	.....	9	8	14	.....	.0	.0
Apalachicola	35	11	51	30.05	30.09	.....	57.6	+1.9	78	4	64	38	15	51	23	53	50	84	3.89	−1.2	8	8.2	n.	24	e.	22	5	8	18	7.1	.0	.0
Pensacola	56	54	79	30.04	30.10	−.05	56.2	+2.2	76	4	64	34	29	48	24	51	47	77	6.16	+1.5	11	8.0	n.	29	se.	22	7	13	11	6.1	.0	.0
Anniston	741	9	.....	.....	.....	.....	48.0	+3.8	72	5	58	24	15	38	32	.....	.....	...	6.89	+1.8	8	.....	nw.	.....	.....	.....	8	11	12	.....	.0	.0
Birmingham [2]	700	11	48	29.36	30.12	−.04	49.8	+3.4	71	5	58	27	29	42	27	42	39	82	5.40	−.3	9	7.2	n.	30	se.	25	10	8	13	5.9	T	.0
Mobile [2]	57	6	30	30.05	30.10	−.05	55.6	+3.4	79	2	65	33	29	46	29	49	46	82	7.34	+2.3	10	9.3	n.	42	se.	22	6	10	15	6.5	.0	.0
Montgomery [2]	218	92	105	29.88	30.11	−.05	52.4	+3.0	75	2	61	31	29	44	26	45	42	77	10.32	+5.5	9	6.7	e.	21	se.	22	7	9	15	6.3	.0	.0
Meridian [2]	375	67	92	29.70	30.11	−.05	50.6	+2.9	75	2	60	28	29	41	31	45	43	86	9.11	+3.9	10	5.1	n.	24	se.	22	10	8	13	5.6	.0	.0
Vicksburg [2]	247	82	102	29.83	30.10	−.05	52.0	+2.0	73	18	60	30	29	44	25	43	40	82	4.61	−.7	8	7.9	n.	24	s.	31	6	11	14	6.5	.0	.0
New Orleans [2]	53	76	84	30.03	30.09	−.04	58.8	+3.2	79	5	66	38	29	52	26	52	48	75	2.89	−1.9	10	7.0	ne.	18	ne.	6	4	13	14	6.7	.0	.0
West Gulf States							**53.2**	**+2.6**										**80**	**2.69**	**−0.2**										**6.7**		
Shreveport [1]	249	92	227	29.83	30.10	−.03	50.4	.....	74	1	60	28	7	41	29	46	43	83	3.37	.....	8	10.0	se.	38	w.	25	5	12	14	6.5	.0	.0
Bentonville	1,303	12	51	28.68	30.08	−.05	42.6	+5.1	70	20	51	23	29	34	37	.....	.....	...	2.18	−.2	8	6.8	s.	20	s.	4	1	23	7	5.8	T	.0
Fort Smith	463	57	82	.....	30.07	−.06	45.6	+3.5	67	1	54	27	28	37	.....	.....	.....	...	2.24	−.6	8	7.2	e.	26	nw.	23	8	8	15	.....	1.1	.0
Little Rock [2]	357	94	102	29.72	30.11	−.03	45.8	+1.6	67	20	53	28	29	39	26	40	37	82	4.94	+.8	9	7.2	nw.	27	w.	23	11	4	16	5.9	T	.0
Austin [2]	605	68	90	.....	30.08	.....	53.8	+2.8	81	22	63	32	29	45	.....	.....	.....	...	2.25	−.4	9	6.3	n.	24	w.	25	6	8	17	.....	.0	.0
Brownsville [2]	57	88	96	29.97	30.03	.....	62.6	+1.4	81	5	69	48	26	56	22	59	58	89	2.98	+1.4	12	8.9	n.	27	n.	23	3	11	17	7.5	.0	.0
Corpus Christi [2]	20	11	78	30.04	30.06	−.06	60.0	+2.0	78	22	66	44	28	54	23	55	53	87	2.89	+1.4	14	8.7	n.	26	n.	25	6	6	19	7.4	.0	.0
Dallas [1]	512	6	46	29.37	30.09	.....	49.9	.....	77	22	60	26	29	40	32	44	40	76	1.97	−.4	9	9.0	se.	32	sw.	25	7	9	15	6.7	.0	.0
Fort Worth [1]	679	35	56	29.36	30.09	−.03	50.0	.....	77	1	60	25	28	40	34	44	40	77	1.88	.0	7	9.6	s.	33	nw.	23	6	13	12	5.8	.0	.0
Galveston [2]	54	106	114	30.01	30.07	−.05	58.2	+1.8	73	18	63	44	28	54	16	53	50	82	1.38	−2.4	7	9.3	n.	29	s.	31	5	9	17	7.3	.0	.0
Houston [2]	138	157	190	29.93	30.08	.....	57.6	+3.2	78	18	64	37	29	51	22	51	48	80	2.32	−1.9	7	9.2	n.	28	nw.	25	7	7	17	6.5	.0	.0
Palestine	510	64	72	29.56	30.10	−.02	52.2	+2.3	76	1	60	31	28	44	29	47	41	72	3.34	−.3	10	6.6	n.	20	nw.	23	7	8	16	6.2	.0	.0
Port Arthur	34	59	134	30.04	30.08	.....	56.4	.....	76	5	63	37	15	50	20	51	47	76	5.66	+.4	5	11.4	n.	43	se.	22	5	7	19	7.1	.0	.0
San Antonio [1]	693	28	59	29.34	30.08	−.03	54.9	.....	80	22	65	31	26	45	35	50	46	77	.97	−.6	9	7.2	ne.	30	nw.	25	4	7	20	7.5	.0	.0

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max.+mean min.÷2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch, or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F		°F	°F		°F	°F	°F	°F	%	In.	In.		Miles							0–10	In.	In.
Ohio Valley and Tennessee							40.6	+5.0										80	2.51	−0.9									7.2		
Chattanooga [1]	762	21	54	29.30	30.13	−.03	44.2		69	1	55	21	15	34	35	39	36	81	5.39		9	5.9	s.	27	w.	8	6	10	15	6.8	.0	.0
Knoxville [2]	995	66	84	29.05	30.13	−.03	45.2	+4.9	67	4	53	22	15	37	30	39	35	74	2.45	−2.1	9	5.5	ne.	19	w.	8	5	12	14	6.6	.0	.0
Memphis [2]	399	78	86	29.67	30.11	−.04	45.2	+1.6	70	20	54	22	29	36	36	42	39	86	4.01	−.5	9	7.4	sw.	32	sw.	23	9	10	12	5.7	.0	.0
Nashville [1]	546	5	72	29.52	30.11	−.04	44.6		69	1	53	22	15	36	35	40	37	79	3.89	−.3	9	8.2	s.	31	sw.	23	7	5	19	7.2	.0	.0
Lexington	989	6		29.03	30.13	−.01	41.0	+5.2	65	3	49	18	11	33	31				2.28	−1.5	11		s.				9	8	14	6.1	T	.0
Louisville [3]	525	106	120	29.53	30.10	−.04	42.0	+4.4	65	1	49	21	11	35	29	37	33	78	3.41	−.3	9	8.8	sw.	34	w.	23	5	6	20	7.4	T	.0
Evansville [1]	431	5	38	29.62	30.10	−.03	40.0		68	1	48	19	14	32	34	36	33	79	2.44	−1.1	8	8.1	sw.	29	nw.	8	4	11	16	7.2	.6	.0
Indianapolis [2]	823	98	129	29.18	30.08	−.04	38.6	+6.4	62	23	44	17	11	33	27	34	32	84	1.58	−1.4	8	8.4	w.	27	w.	5	2	8	21	8.0	.1	.0
Terre Haute [2]	575	68	149	29.47	30.10		39.0		62	23	45	17	11	33	25	34	32	83	1.86	−1.1	9	9.4	sw.	29	se.	22	8	6	17	6.9	4.1	.0
Cincinnati [3]	627	11	51	29.42	30.11	−.02	39.3	+5.9	64	4	46	17	11	33	28	35	32	80	2.70	−.3	9	8.0	sw.	26	w.	5	3	9	19	7.7	T	.0
Columbus [2]	822	90	110	29.20	30.10	−.02	38.2	+5.8	64	4	44	17	15	32	23	34	31	81	1.78	−1.0	9	9.9	s.	32	sw.	8	1	8	22	8.4	T	.0
Dayton [2]	900	186	213	29.11	30.10		38.3	+5.7	66	4	44	14	11	32	25	34	31	84	3.31	+.6	7	10.8	sw.	33	w.	5	4	8	19	7.6	T	.0
Elkins [2]	1,947	61	78	28.02	30.13	+.01	38.1	+5.4	66	1	47	13	11	29	38	32	28	75	2.57	−.9	13	6.9	w.	27	w.	24	6	4	21	7.5	2.6	.0
Parkersburg	637	77	84	29.41	30.11	−.03	40.0	+4.8	67	22	48	17	11	32	34	36	31	74	1.17	−1.9	8	6.1	se.	25	sw.	8	4	9	18	7.3	T	.0
Pittsburgh [1]	842	39	54	29.17	30.09	−.02	37.1		70	4	44	15	11	31	31	34	30	76	1.73	−1.1	12	11.5	w.	34	w.	8	1	8	22	8.1	T	T
Lower Lake Region							33.1	+4.0										82	2.03	−0.7									8.4		
Buffalo [2]	768	243	280	29.19	30.05	−.01	33.8	+4.0	70	4	40	12	21	28	32	31	27	79	1.36	−2.0	13	17.0	w.	57	w.	5	3	5	23	8.1	7.8	.1
Canton	448	10	61	29.54	30.04		23.8	+1.1	70	5	34	−17	21	14	38	22	20	89	2.74	.0	16	8.3	w.	30	w.	6	4	8	19	7.5	13.8	1.7
Ithaca	836	77	100				32.5	+3.5	65	4	40	7	12	25	31				2.25	−.1	14	10.8	nw.	26	nw.	6	2	5	24	8.5	5.4	1.0
Oswego	335	71	85	29.66	30.05	−.01	31.2	+2.2	62	5	38	3	21	24	34	29	25	77	3.06	−.4	20	11.3	se.	35	n.	20	1	6	24	8.5	14.2	.7
Rochester [1]	523	5	69	29.46	30.05	−.01	31.8		66	4	39	5	30	24	32	30	27	86	2.24	−.5	17	11.2	sw.	38	sw.	6	2	7	22	8.1	5.9	.5
Syracuse [1]	596	5	51	29.38	30.05	−.02	31.0		68	4	39	−1	12	22	36	29	26	84	2.96	−.1	18	10.4	sw.	30	sw.	24	2	4	25	8.6	19.0	.4
Erie [2]	714	57	81	29.27	30.06	−.01	37.0	+5.1	70	4	42	16	21	32	27	34	31	82	1.56	−1.3	10	10.0	sw.	27	sw.	24	1	4	26	9.1	3.6	T
Cleveland [1]	762	27	54	29.23	30.07	−.02	36.9		69	4	42	18	15	32	25	34	30	78	1.76	−.7	13	12.2	w.	43	w.	5	0	5	26	9.1	3.1	.3
Sandusky	629	5	67				37.5	+6.3	69	4	43	15	11	32	25				1.54	−.7	11	10.3	sw.	29	sw.	5	1	7	23	8.6	1.0	.0
Toledo [2]	628	79	87	29.37	30.07	−.01	36.2	+5.8	62	4	41	13	15	31	27	33	30	82	1.59	−.8	9	10.3	w.	38	w.	5	3	7	21	8.0	2.1	T
Fort Wayne [1]	857	69	84	29.12	30.07		34.4		60	4	40	7	14	29	28	33	31	88	1.94	−.6	12	9.7	w.	35	w.	5	0	8	23	8.5	3.5	T
Detroit [1]	730	5	78	29.26	30.06	−.01	35.6		64	4	41	17	11	30	26	33	29	77	1.31	−1.0	9	11.0	nw.	38	sw.	5	3	7	21	8.2	3.4	T
Upper Lake Region							30.0	+6.3										82	1.55	−0.5									8.3		
Alpena	609	5	89	29.33	30.01	−.01	30.0	+5.2	54	5	35	10	29	25	21	29	27	86	1.76	−.3	18	12.3	nw.	36	nw.	5	1	7	23	8.5	8.7	2.0
Escanaba	612	51	72		30.02	−.01	28.6	+6.2	47	4	34	7	11	23				79	1.70	.0	12	12.4	nw.	35	nw.	5	2	7	22		6.9	3.2
Grand Rapids [2]	707	70	244	29.24	30.03	−.02	35.8	+7.3	63	4	40	18	10	31	20	32	29	83	1.45	−1.1	10	11.7	s.	46	sw.	5	1	7	23	8.5	5.4	1.8
Lansing [3]	878	5	90	29.08	30.05		34.3	+7.1	64	4	39	16	10	29	22	31	29	83	1.83	−1.2	13	9.7	s.	36	sw.	5	1	9	21	8.4	4.0	2.0
Marquette	734	44	73	29.16	29.98	−.04	28.8	+6.2	56	2	34	9	10	24	26	27	24	80	1.73	−.9	19	10.9	s.	38	sw.	3	1	5	25	8.8	7.6	1.0
Sault Sainte Marie [2]	614	11	52	29.30	29.99	−.01	23.8	+3.3	52	4	30	−3	20	17	27	24	22	87	2.93	+.7	20	12.3	e.	40	w.	18	1	3	27	9.1	15.4	2.0
Chicago	673	7	131	29.31	30.06	−.02	36.4	+7.6	59	23	41	12	10	31	23	34	30	76	.97	−1.1	9	10.4	s.	32	sw.	5	5	4	22	8.0	1.7	.4
Green Bay	617	109	141	29.32	30.01	−.03	30.0	+7.7	53	4	36	3	10	24	28	29	25	80	1.45	−.3	13	11.8	s.	33	nw.	5	6	1	24	8.0	9.5	3.7
Milwaukee [1]	681	33	66	29.28	30.04	−.02	32.2		55	23	38	5	10	26	23	30	28	83	1.29	−.4	7	12.7	nw.	36	sw.	5	5	1	25	8.1	8.5	2.6
Duluth	1,133	5	47	28.74	30.01	−.04	22.4	+6.5	54	4	30	−7	10	15	30	19	17	86	.41	−.7	6	14.5	nw.	43	nw.	5	6	5	20	7.2	4.6	T
North Dakota							21.7	+10.1										81	0.17	−0.4									6.4		
Moorhead, Minn. [2]	940	50	58	28.97	30.03	−.05	21.0	+9.5	55	2	30	−7	31	12	34	18	16	85	.22	−.5	5	9.1	n.	25	n.	8	6	9	16	6.7	2.6	T
Bismarck [1]	1,677	4	41	28.18	30.04	−.04	23.8		55	2	34	−5	10	14	36	20	17	78	.09	−.5	3	9.6	nw.	40	nw.	7	4	11	16	6.8	1.0	.6
Devils Lake	1,478	11	44	28.38	30.01	−.05	19.6	+10.1	56	3	28	−12	10	12	32	18	16	89	.18	−.4	7	8.5	nw.	27	nw.	17	6	6	19	7.1	1.9	.2
Lemmon, S. Dak	2,602	4	38	27.20	30.02		26.2		60	20	37	−13	31	16	37	22	17		.08		2		s.				7	7	15		2.0	1.0
Grand Forks	832	11	71	29.10	30.04		17.4		52	3	26	−11	10	8	38	16	14		.21		8		nw.				4	8	19		3.3	1.0
Williston	1,878	42	50	27.97	30.01	−.05	24.6	+10.8	57	3	33	−14	31	16	28	21	16	72	.20	−.4	5	6.8	s.	33	nw.	7	14	7	10	4.8	1.9	1.3
Upper Mississippi Valley							35.2	+7.5										82	1.94	+0.2									6.8		
Minneapolis-St. Paul, Minn	919	32	61	28.99	30.02	−.06	26.2		56	4	34	−3	10	19	28	24	20	80	.85	−.1	10	11.5	nw.	33	nw.	5	8	8	15	6.5	8.6	1.2
Springfield, Minn	1,025	4	42	28.88	30.02		26.3		58	3	34	−3	29	18	34	25	21		.85		7		nw.				8	8	15		9.0	2.9
La Crosse [2]	714	11	48	29.23	30.03	−.05	29.9	+7.6	56	4	37	1	29	23	24	26	24	84	2.08	+.8	11	6.4	s.	24	nw.	5	5	5	21	7.5	16.8	9.5
Madison [2]	974	70	78	28.96	30.04	−.04	30.4	+7.6	52	4	36	3	10	25	21	28	26	84	1.77	+.1	10	9.3	nw.	26	nw.	5	5	8	18	7.1	10.8	8.5
Charles City	1,015	10	51	28.92	30.05	−.05	29.6	+9.2	56	21	38	−1	29	22	30	27	25	83	2.26	+1.0	11	7.6	se.	22	nw.	8	9	7	15	6.3	19.5	7.9
Davenport [3]	606	66	161	29.38	30.06	−.04	35.0	+7.9	58	21	42	8	29	28	25	32	29	85	1.31	−.2	9	9.5	nw.	31	nw.	8	5	4	22	7.3	6.1	2.8
Des Moines [2]	860	5	99	29.09	30.03	−.08	33.3	+7.3	62	21	41	5	10	26	34	30	27	82	2.84	+1.6	11	10.6	nw.	30	nw.	8	7	5	19	6.9	8.6	4.1
Dubuque	699	60	79	29.27	30.04	−.06	32.4	+7.7	54	21	39	6	10	26	25	30	26	78	2.08	+.7	13	6.7	nw.	24	nw.	5	6	4	21	7.4	12.1	6.6
Keokuk	614	64	78				37.8	+8.2	66	20	45	12	29	31	30				2.12	+.7	5						12	3	16	5.9	1.4	.5
Cairo	358	87	93	29.72	30.11	−.04	42.8	+5.0	67	1	49	21	29	36	30				3.90	+.5	7	8.0	sw.	34	sw.	23	4	11	16	6.7	T	.0
Peoria [2]	609	11	45	29.39	30.07	−.04	36.4	+8.3	60	21	43	12	29	30	26	33	31	84	1.38	−.4	10	6.4	s.	24	sw.	5	8	6	17	6.6	3.6	1.8
Springfield, Ill. [2]	636	5	191	29.37	30.07	−.05	38.6	+6.9	64	1	45	16	29	33	27	34	31	84	1.47	−.7	8	11.5	s.	34	nw.	8	5	7	19	7.5	1.7	.0
St. Louis [1]	568	265	303	29.46	30.08	−.05	41.3	+6.4	67	20	48	18	29	35	27	37	32	71	1.20	−1.0	8	11.6	nw.	32	nw.	8	8	7	16	6.5	2.2	.0
Missouri Valley							36.0	+6.6										79	2.02	+0.9									6.4		
Columbia, Mo. [2]	784	6	66	29.21	30.08	−.04	39.6	+6.4	68	20	47	17	29	32	32	35	31	78	1.81	.0	6	7.8	s.	23	sw.	5	7	11	13	6.3	2.3	.0
Kansas City [1]	963	38	76	29.00	30.06	−.06	40.0		67	20	48	17	28	32	32	36	31	73	1.76		7	11.3	nw.	39	nw.	5	8	7	16	6.3	3.9	T
St. Joseph [2]	907	11	49	29.00	30.06		38.0	+8.4	67	20	45	13	10	31	27	34	32	88	2.04	+.8	7	9.5	nw.	33	w.	22	7	7	17	6.9	4.7	T
Springfield, Mo. [2]	1,324	5	60	28.65	30.08	−.05	39.2		66	20	47	18	13	31	30	35	32	80	2.58	+.3	7	11.4	se.	32	sw.	7	10	5	16	6.2	2.3	.0
Topeka	987	65	87	28.98	30.06		39.0	+7.0	67	20	47	16	10	31	29	35	31	77	2.07	+1.1	5	9.5	s.	29	sw.	21	10	8	13	5.8	3.4	.0
Lincoln [3]	1,189	11	81	28.74	30.05	−.07	33.8	+6.2	63	20	42	3	28	25	33	29	26	85	3.51	+2.7	6	10.6	s.	34	nw.	7	9	8	14	6.2	12.8	4.5
Omaha [1]	1,105	31	44	28.83	30.05	−.06	33.0		62	21	42	8	10	24	32	30	27	82	3.30	+2.4	8	12.2	se.	34	nw.	5	6	7	18	6.9	10.8	2.0
Valentine	2,598	46	54	27.24	30.05	−.05	29.7	+5.1	72	20	41	−10	28	18	41	24	18	70	.48	−.1	5	9.2	w.	33	nw.	17	11	7	13	5.7	4.6	3.3
Sioux City [1]	1,138	5	27	28.79	30.04	−.08	29.0		60	21	39	−2	27	19	32	27	24	82	.84		10	10.6	se.	34	nw.	7	4	9	18	7.1	9.0	6.0
Huron [1]	1,301	26	41	28.59	30.03	−.07	27.8		69	3	37	−2	31	18	35	24	21	79	.34	−.2	5	13.9	n.	45	nw.	7	8	9	14	6.4	3.9	1.1
Northern Slope							27.8	+4.4										74	0.70	0.0									6.7		
Billings [1]	3,570	18	39	26.24	30.00		28.3		63	3	37	−17	31	20	30	24	19	73	1.13		10	11.5	sw.	45	nw.	17	5	11	15	6.8	11.3	7.2
Havre	2,507	11	67	27.28	30.00	−.05	24.0	+3.6	66	3	35	−26	28	13	38	20	15	69	.48	−.1	5	9.3	sw.	39	sw.	2	10	7	14	6.2	7.4	5.2
Helena [1]	4,124	5	35	25.71	30.06	−.07	24.5		59	19	34	−29	31	15	34	22	17	76	.77	.0	10	8.7	w.	55	s.	3	6	6	18	6.8	14.6	9.4
Missoula [2]	3,205	80	91	26.57	30.03		29.4	+4.9	58	3	36	−6	31	22	27	26	24	84	.93	−.2	16	7.3	se.	38	e.	30	4	3	24	8.2	5.9	2.4
Kalispell	2,973	48	56	26.85	29.98	−.09	28.5	+3.6	57	2	34	−8	31	22	27	24	85	1.05	−.4	13	5.1	w.	26	n.	30	3	2	26	8.2	6.2	0.5
Miles City [2]	2,371	48	55	27.46	30.03	−.07	27.8	+6.8	58	3	37	−20	31	19	26	23	18	75	.55	−.1	6	5.8	s.	34	nw.	17	5	7	19	7.4	4.6	4.0
Rapid City [2]	3,259	50	58	26.56	30.03	−.06	31.3	+4.4	74	3	42	−8	31	20	37	24	17	64	.48	.0	7	7.6	w.	37	w.	17	9	9	13	6.2	5.8	2.7
Cheyenne [1]	6,094	5	39	23.90	30.02	−.07	29.8		67	20	42	−13	31	18	43	23	15	60	.72	+.2	7	11.8	nw.	44	w.	18	5	14	12	6.4	8.0	1.4
Lander	5,352	60	68	24.57	30.04	−.11	25.2	+4.8	61	3	36	−18	31	14	30	22	15	66	.75	+.1	8	4.3	sw.	45	sw.	3	9	13	9	5.5	10.6	4.8
Sheridan [4]	3,790	6	42	26.03	30.03		25.2	+2.4	71	3	36	−14	31	14	44	21	18	80	.80	+.2	9	7.3	nw.	43	nw.	17	3	10	18	7.4	9.9	4.1
North Platte [2]	2,821	11	51	27.03	30.05	−.05	31.0	+4.3	66	21	43	−6	28	19	42	24	20	77	.42	−.1	9	7.7	nw.	23	n.	4	12	9	10	4.9	5.1	3.3

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max.+mean. min.÷2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch, or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
Middle Slope	*Ft.*	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	°F.	°F.	°F	°F		°F		°F	°F	°F	°F	%	*In.*	*In.*		*Miles*							*0–10*	*In.*	*In.*
							39.2	+5.0										72	0.97	+0.2									5.5		
Denver [1]	5,292	106	113	24.65	30.00	−.08	35.0	------	70	6	46	−5	31	24	41	25	15	57	1.03	+.3	5	7.5	s.	27	w.	4	14	10	7	4.3	10.6	2.8
Pueblo [1]	4,690	5	36	25.22	30.02	−.06	32.6	------	70	3	49	−5	26	16	50	25	17	62	.47	−.0	7	8.2	w.	49	w.	4	13	9	9	5.1	11.0	3.7
Concordia	1,392	50	58	28.54	30.05	−.06	36.1	+5.4	65	20	45	7	28	27	27	32	28	79	1.97	+1.3	7	9.2	s.	27	nw.	7	9	10	12	5.7	7.8	1.5
Dodge City	2,509	10	86	27.38	30.03	−.07	37.2	+4.6	69	4	48	5	31	27	37	32	27	74	.37	−.2	7	11.4	s.	31	sw.	4	7	9	15	6.5	3.3	.1
Wichita [1]	1,358	6	64	28.58	30.05	−.06	39.6	------	64	19	48	15	31	31	29	35	32	81	.92	−.1	6	15.0	s.	42	s.	4	9	5	17	6.3	3.6	.0
Oklahoma City [2]	1,214	10	47	28.77	30.08	−.03	44.3	+5.0	68	19	53	24	27	36	29	39	35	77	1.07	−.4	9	8.9	s.	22	sw.	25	12	9	10	5.2	.1	.0
Southern Slope							46.4	+2.4										72	0.55	−0.3									5.4		
Abilene [2]	1,738	10	56	28.22	30.05	−.06	49.2	+3.2	78	4	59	24	28	39	37	41	36	73	.93	−.4	3	8.6	s.	30	s.	24	12	5	14	5.6	.0	.0
Amarillo [3]	3,676	10	49	26.24	30.02	−.07	39.6	+2.6	69	4	50	14	31	29	38	34	30	77	.68	−.1	5	14.1	s.	46	w.	4	12	7	12	5.3	1.8	T
Del Rio	960	63	71	29.04	30.04	−.06	54.0	+1.8	76	22	64	33	27	44	31	49	43	72	.25	−.4	8	7.3	se.	30	w.	25	5	12	14	6.2	.0	.0
Roswell	3,566	75	85	26.37	30.03	−.04	43.0	+1.8	73	4	57	21	28	29	40	36	29	66	.34	−.3	3	6.8	s.	34	sw.	31	15	6	10	4.5	.5	.0
Southern Plateau							50.1	+2.2										61	1.15	+0.4									4.7		
El Paso [2]	3,778	82	101	26.18	30.01	−.02	48.2	+3.3	70	4	60	23	26	37	34	38	29	58	.35	−.2	3	7.7	w.	32	w.	25	17	8	6	4.1	T	.0
Albuquerque [1]	5,314	5	45	24.72	30.02	------	37.7	------	60	1	49	18	26	27	32	31	24	63	.23	−.2	3	7.9	n.	39	nw.	4	9	10	12	5.7	2.0	.0
Phoenix [2]	1,107	39	87	28.82	29.98	−.06	54.2	+2.2	80	2	66	30	25	43	36	45	39	67	1.36	+.4	9	5.0	e.	22	sw.	31	12	7	12	5.1	.0	.0
Tucson [1]	2,555	5	23	27.34	29.97	------	52.0	------	82	3	64	28	23	40	38	44	36	62	2.01	+1.0	7	------	se.	------	------	------	12	10	9	5.1	1.2	.0
Yuma	142	9	54	29.86	30.01	−.04	57.7	+2.5	82	2	69	34	25	46	29	49	40	56	.42	−.1	4	6.1	n.	25	w.	31	18	9	4	3.3	.0	.0
Independence	3,957	5	26	25.94	30.03	−.09	40.2	+.9	63	1	51	15	27	30	32	35	28	...	2.52	+1.7	10	------	s.	------	------	------	8	10	13	...	16.2	8.6
Middle Plateau							34.9	+5.1										76	1.66	+0.7									7.0		
Reno [2]	4,527	61	76	25.39	29.99	−.16	37.2	+3.9	64	2	45	15	31	29	28	32	28	78	2.69	+1.7	13	4.8	w.	28	s.	16	7	4	20	7.2	21.0	9.1
Tonopah	6,090	12	20	23.96	30.01	------	31.8	------	52	20	39	10	27	25	25	29	27	...	.61	------	9	------	se.	------	------	------	10	3	18	...	7.2	2.5
Winnemucca	4,339	5	56	25.55	29.99	−.19	35.0	+5.0	63	2	45	6	26	25	31	31	27	76	1.35	+.3	12	7.9	sw.	58	sw.	16	5	6	20	7.5	11.1	7.1
Modena	5,473	10	46	------	------	------	31.0	+2.9	62	2	42	−4	27	20	36	------	------	...	1.51	+.7	12	8.0	sw.	32	s.	16	8	2	21	6.8	14.4	6.0
Salt Lake City [1]	4,357	86	210	25.57	30.03	−.12	36.4	+6.2	61	3	44	15	26	29	31	31	28	81	2.26	+.9	13	8.2	se.	38	s.	3	5	5	21	7.7	16.4	6.0
Grand Junction	4,602	60	68	25.38	30.02	−.08	34.9	+7.4	61	3	44	18	23	26	32	30	25	71	.49	−.1	4	5.0	s.	30	s.	3	9	9	13	5.9	3.2	.1
Northern Plateau							35.8	+4.6										83	2.06	+0.3									8.1		
Baker [2]	3,471	36	54	26.36	29.99	−.17	31.8	+4.5	57	2	39	4	31	24	22	30	28	88	1.98	+.3	18	6.3	s.	26	ne.	3	3	5	23	8.3	9.9	2.5
Boise [1]	2,739	5	49	27.12	30.02	−.18	35.0	------	60	2	42	0	31	28	27	33	30	84	1.77	------	16	11.2	se.	45	s.	16	5	5	21	7.6	11.0	6.0
Pocatello [1]	4,478	5	31	25.42	30.04	−.15	29.8	------	56	2	38	−10	27	22	32	28	25	83	2.03	------	16	9.6	s.	41	w.	16	2	7	22	8.1	12.3	6.3
Spokane [1]	1,929	27	42	27.89	29.97	−.11	33.7	------	58	16	40	2	31	27	22	32	30	83	2.78	+.6	19	6.5	sw.	30	sw.	3	3	6	22	8.1	6.8	1.7
Walla Walla	991	57	65	28.88	29.97	−.15	40.2	+4.7	68	2	46	6	31	34	26	------	------	...	2.04	.0	18	6.5	s.	36	w.	2	1	0	30	9.3	4.3	4.0
Yakima	1,076	58	67	28.80	29.97	------	35.4	+4.7	55	2	41	10	31	30	21	33	30	78	1.46	+.4	15	4.4	w.	27	nw.	3	5	6	20	7.4	3.6	.1
North Pacific Coast Region							43.8	+1.6										83	8.82	+1.7									8.0		
North Head	211	5	56	29.64	29.87	−.16	44.2	+.1	57	2	49	25	31	40	16	42	40	85	10.41	+.9	23	15.7	e.	67	s.	14	4	8	19	7.5	T	.0
Seattle [2]	125	90	321	29.76	29.90	−.11	43.9	+2.2	59	2	48	27	31	40	19	40	36	77	7.08	+1.5	19	11.1	se.	42	sw.	15	5	3	23	7.6	.0	.0
Tacoma	194	172	201	29.67	29.88	−.13	42.2	+1.6	62	2	47	26	31	38	19	...	...	...	7.87	+1.2	19	9.1	s.	34	s.	15	4	4	23	8.0	T	.0
Tatoosh Island	86	9	61	29.74	29.84	−.12	44.5	+.6	56	2	48	30	31	41	14	42	37	74	9.67	−3.7	22	20.2	e.	71	sw.	15	8	9	14	6.5	T	.0
Medford [1]	1,329	29	58	28.54	29.98	------	40.2	------	64	15	45	21	31	35	22	39	37	90	7.97	+4.9	21	------	nw.	------	------	------	0	5	26	9.0	.9	.0
Portland, Oreg. [2]	154	68	106	29.75	29.92	−.15	43.8	+2.6	62	1	48	23	31	40	14	41	38	85	10.38	+3.7	19	7.2	se.	26	e.	31	3	5	23	8.1	T	.0
Roseburg	510	45	76	29.38	29.94	−.17	44.0	+2.2	66	15	50	25	31	38	21	42	41	88	8.80	+3.5	25	3.7	s.	23	sw.	15	0	7	24	9.0	3.8	T S
Middle Pacific Coast Region							50.7	+2.1										80	9.85	+5.1									7.2		
Eureka	60	72	88	29.92	29.99	−.13	49.4	+1.2	68	2	55	34	26	44	17	47	45	84	12.87	+6.6	23	7.8	se.	28	s.	15	3	4	24	7.9	.0	.0
Redding [1]	722	20	34	29.21	29.99	------	46.6	------	69	7	53	29	31	41	26	43	39	76	12.95	+7.3	18	7.9	nw.	34	s.	15	4	7	20	7.4	4.1	.0
Sacramento [2]	66	92	115	29.94	30.01	−.13	49.2	+3.0	65	15	56	34	31	43	25	47	44	83	6.29	+3.2	17	7.9	se.	28	se.	27	5	9	17	7.0	.0	.0
San Francisco	155	112	132	29.83	30.00	−.12	53.4	+2.1	68	2	58	41	31	49	16	50	46	78	7.29	+3.3	19	8.0	se.	31	se.	27	4	13	14	6.7	T	T
South Pacific Coast Region							54.5											75	3.74	+1.8									5.8		
Fresno [1]	327	5	35	29.69	30.05	−.08	49.0	------	68	15	57	33	6	41	27	46	44	84	4.16	+2.7	18	5.1	se.	28	nw.	3	7	9	15	6.8	.0	.0
Los Angeles	338	223	250	29.65	30.01	−.06	57.0	+.4	81	7	65	40	25	49	27	49	41	61	4.22	+1.6	10	8.3	nw.	32	nw.	21	12	11	8	4.9	.0	.0
San Diego [1]	87	20	55	29.93	30.02	−.05	57.6	------	78	7	66	44	25	49	30	53	50	80	2.85	+1.0	14	5.9	w.	26	w.	31	11	9	11	5.7	.0	.0
West Indies																															
San Juan, P. R.	82	10	54	29.89	29.98	------	77.8	+1.5	87	29	83	71	31	73	15	...	...	...	3.24	−2.3	18	9.2	e.	26	ne.	23	6	25	0	5.1	.0	.0
Panama Canal																															
Balboa Heights	118	6	92	------	[3] 29.81	−.01	80.9	+.9	91	6	88	72	16	73	18	...	...	[3]84	5.40	+.8	13	6.2	nw.	22	n.	20	3	23	5	5.7	.0	.0
Cristobal	36	6	97	------	[3] 29.82	−.02	82.2	+2.3	88	11	86	75	3	78	12	76	75	[3]81	6.11	−5.3	13	10.0	n.	21	ne.	19	0	19	12	7.0	.0	.0
Alaska																															
Fairbanks	455	11	44	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Juneau	80	96	116	------	[4] 29.70	------	29.5	−1.7	46	13	33	15	3	26	...	...	...	...	4.97	−2.6	20	6.3	s.	26	ne.	19	2	2	27	...	39.8	9.1
Nome	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hawaiian Islands																															
Honolulu (November)	38	86	100	------	------	------	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

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Alaska																															
Anchorage	135	36	47[4]	29.51[4]	29.66	------	19.4	−3.0	42	22	25	2	24	14	29	20	16	81	1.02	.0	9	7.1	n.		44	n.	28	13	6	11	4.8	10.8	1.2
Barrow	25	4	27[4]	29.95[4]	29.97	------	−3.2	−3.2	22	22	3	−31	27	−10	31	−4	−5	...	.33	+.7	11	13.6	se.	------	------	------	------	------	------	6.7	3.1	4.3
Bethel	22	5	32[4]	29.80[4]	29.84	------	15.2	−2.0	41	17	23	−10	27	7	42	16	12	78	2.23	+1.2	11	------	ne.	------	------	------	10	9	11	5.7	7.8	3.2
Ketchikan	75	69	85[4]	29.73[4]	29.76	------	41.5	+1.4	55	4	46	29	21	37	16	40	38	87	25.51	+5.6	25	7.8	se.	34	se.	4	2	2	26	8.9	2.4	1.0

[1] Data are airport records.
[2] Barometric data (adjusted to old city elevation) and hygrometric data from airport; otherwise city office records.
[3] Observations taken hourly.
[4] Pressure not reduced to a mean of 24 hours.
[5] Barometric data from airport records, other data from city office records.
[6] Wind, clear, partly cloudy and cloudy data from city office records, other data from airport.

NOTE.—Except as indicated by notes 1, 2, 5, and 6 data in table are city office records

SEVERE LOCAL STORMS, DECEMBER 1941

[Compiled by Mary O. Souder]

[The table herewith contains such data as has been received concerning severe local storms that occurred during the month. A revised list of tornadoes will appear in the United States Meteorological Yearbook]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Libby, Mont., vicinity of	2-3				$1,330	Heavy rain	Damage to roads and bridges.
California, the Bay area and parts of the northern portion.[2]	16	A. m.				Wind and rain	San Francisco escaped damage except that some trees were blown down and basements flooded. In Oakland 2 houses were unroofed letting in sheets of rain on the surprised occupants. At Dunsmuir basements of some business establishments were flooded. Tons of dirt and rock, loosened by rains in widely scattered sections of the State, caused State Scenic Route 28, between Geyserville and Calistoga in Sonoma County, to be closed. State Route 1, the coast road south of San Francisco, was closed temporarily by slides between Rockaway Beach and Half Moon Bay. There were reports of fallen trees and temporary light disruption in some peninsula localities.
Winfield, Kans.	22	2 p. m.	[1] 1		4,000	Hail	Windshields, glass in greenhouses, and electric signs broken; path 2 miles long.
Saunders and Seward Counties, Nebr.	22	7-9 p. m.	[1] 10		2,000	Ice	Loss chiefly to utilities.
Mamou, Morrow, and[2] Goudreau, La., and vicinities.	25	11 a. m.		0	15,000	Tornado and heavy rain.	Storm started in the vicinity of Mamou and ended in Goudreau. 18 homes were leveled and 16 persons injured. Galvanized roofing, pieces of lumber, and household furniture found more than a mile from the scene of the tornado.
Oloh, Miss.	31					Squall	Several houses blown down and timber damaged.

[1] Miles instead of yards.
[2] From press reports.

SOLAR RADIATION AND SUNSPOT DATA FOR DECEMBER 1941

[Solar Radiation Investigations Section, I. F. HAND in charge]

SOLAR RADIATION OBSERVATIONS

BY IOLA PAINE

Measurements of solar radiant energy received at the surface of the earth are made at 9 stations maintained by the Weather Bureau and at 12 cooperating stations maintained by other institutions. The intensity of the total radiation from sun, and sky on a horizontal surface is continuously recorded (from sunrise to sunset) at all these stations by self-registering instruments; pyrheliometric measurements of the intensity of direct solar radiation at normal incidence are made at frequent intervals on clear days at three Weather Bureau stations (Madison, Wis.; Lincoln, Nebr.; and Albuquerque, N. Mex.), and at the Blue Hill Observatory at Harvard University. Occasional observations of sky polarization are taken at the Weather Bureau station at Madison and at Blue Hill Observatory.

The geographic coordinates of the stations, descriptions of the instrumental equipment, station exposures, and methods of observation, together with summaries of the data obtained, up to the end of 1939, are given in the MONTHLY WEATHER REVIEW for December 1937, April 1941, and September 1941.

Table 1 contains the measurements of the intensity of direct solar radiation at normal incidence, with means and their departures from normal (means based on less than 3 values are in parentheses). At Lincoln, Madison, Albuquerque, and Blue Hill the observations are obtained with a recording thermopile, checked by observations with a Smithsonian silver-disk pyrheliometer at Blue Hill. The table also gives vapor pressures at 7:30 a. m. and at 1:30 p. m. (75th meridian time).

Table 2 contains the daily total amounts of radiation received on a horizontal surface from both sun and sky for all stations except Fairbanks, Alaska; and also the weekly means, their departures from normal, and the accumulated departures since the beginning of the year. The values at most of the stations are obtained from the Eppley pyrheliometer recording either on a microammeter or a potentiometer. If the daily figures for total solar and sky radiation at Fairbanks should be desired, they may be obtained approximately 2 months after the date of the observation by writing to the Solar Radiation Investigations Supervisory Station, Blue Hill Observatory, Milton, Mass. Table 2 also includes values of ultraviolet radiation below 3132 Angströms at San Juan (see MO. WEA. REV., Sept. 1941, p. 286).

Radiation at normal incidence was close to normal at all stations during December. Lincoln reports that since the removal of the normal-incidence apparatus from the university experimental station to the downtown office, heavy smoke from nearby chimneys has at times seriously interfered with direct radiation readings.

Total solar and sky radiation received on a horizontal surface during December was above average for all stations for which normals have been computed with the exception of Madison, Lincoln, LaJolla, Blue Hill, Ithaca, and Fairbanks.

The average departure for continental United States in 1941 was +1.7 percent, and for all stations which had complete data for the year and including Alaska was +0.7 percent. Polarization measurements made at Madison on three days gave an average of 75 percent with a maximum of 77 percent on the 18th. Both of these values are above the December normals.

TABLE 1.—*Solar radiation intensities during December 1941*

[Gram-calories per minute per square centimeter of normal surface]

LINCOLN, NEBR.

Date	Sun's zenith distance: 7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.
	75th mer. time	Air mass: A. M.					P. M.				Local mean solar time
	e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
Dec. 1	6.50							1.03			6.27
Dec. 2	3.63							1.20	1.09	0.99	6.02
Dec. 5	4.75							1.24	1.14	1.05	4.95
Dec. 6	2.62	0.87	1.04	1.22							4.37
Dec. 8	3.00	1.05	1.18	1.31				1.31	1.20	1.11	3.81
Dec. 10	.97	.94	1.04	1.18							1.52
Dec. 18	3.45		1.05	1.22							5.79
Dec. 23	3.45							1.16	1.07	.99	2.74
Means		.95	1.08	1.23				1.19	1.12	1.03	
Departures		−.01	−.02	−.01				−.01	+.06	+.08	

ALBUQUERQUE, N. MEX.

Dec. 1	3.82	0.98	1.12	1.24					1.14	1.05	4.36
Dec. 2	3.59				1.39		1.38	1.19	1.09	1.02	4.17
Dec. 4	4.17							1.34	1.16	1.08	3.00
Dec. 5	1.97	1.13	1.22	1.35			1.48				2.06
Dec. 7	2.49	1.10	1.24	1.35			1.45	1.34	1.20	1.11	2.61
Dec. 8	2.38	1.05		1.24	1.38			1.29	1.18	1.05	2.86
Dec. 9	2.38	1.01	1.10	1.26							2.61
Dec. 12	4.58			1.24	1.41						4.95
Dec. 15	3.46								1.04	.90	3.82
Dec. 16	3.30				1.40			1.21	1.18	1.08	3.59
Dec. 18	3.30	1.08	1.18	1.31	1.47			1.28	1.18	1.08	3.82
Dec. 19	3.00	1.12	1.19	1.33			1.46		1.20	1.09	3.00
Dec. 23	2.06	1.13	1.24	1.34	1.45						2.26
Dec. 30	3.63	1.07	1.18	1.30	1.46		1.48	1.34	1.21	1.12	3.99
Dec. 31	3.45	1.03	1.16	1.37							3.81
Means		1.07	1.18	1.30	1.42		1.45	1.28	1.16	1.06	

TABLE 1.—*Solar radiation intensities during December 1941*—Con.

[Gram-calories per minute per square centimeter of normal surface]

MADISON, WIS.

Date	Sun's zenith distance: 7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.
	75th mer. time	Air mass: A. M.					P. M.				Local mean solar time
	e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
Dec. 2	3.98								1.14		4.75
Dec. 6	2.06			1.26		1.66					1.96
Dec. 10	.74		1.03	1.28		1.71		1.26			1.02
Dec. 18	3.98	0.92	1.10	1.25		1.65		1.25			4.17
Dec. 19	3.98	.98	1.11	1.21		1.52		1.19			4.75
Means		(.95)	1.08	1.25		1.64		1.21			
Departures		−.03	−.02	+.03		+.04		−.01			

BLUE HILL, MASS.

Dec. 8	1.6							1.25	1.11	0.99	1.9
Dec. 11	1.3	0.97	1.06					1.21	1.10	.99	1.4
Dec. 17	3.5			0.91					.81	.71	3.5
Dec. 19	4.0	.76		1.06						.95	3.3
Dec. 21	.6	1.03	1.11	1.29				1.29	1.19	1.11	.9
Dec. 22	1.0	1.06	1.15	1.25				1.03			1.5
Dec. 25	4.2	.92		1.11				1.19	1.09	1.03	4.2
Dec. 28	2.9	.89	.98	1.12							3.0
Means		.94	1.08	1.12				1.20	1.06	.96	
Departures		+.05	+.02	−.06				+.05	+.01	−.04	

*Extrapolated.

TABLE 2.—*Average daily totals and weekly means of solar radiation (direct and diffuse) received on a horizontal surface*

[Gram-calories per square centimeter]

Date	Washington	Madison	Lincoln	New York	Chicago	Fresno	Albuquerque	Fairbanks	Newport	Cambridge	Friday Harbor	Riverside	New Orleans	La Jolla	State College	Ithaca	Twin Falls	Blue Hill
	cal.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
Dec. 3	165	43	224	150	18	124	261		190	119	122	55	55	91	145	169	42	206
Dec. 4	118	79	161	133	36	235	274		45	183	130	302	306	318	137	173	83	193
Dec. 5	79	33	239	17	17	255	312		101	96	28	296	263	303	57	54	215	158
Dec. 6	223	206	234	213	121	240	298		176	153	104	292	362	284	58	29	81	169
Dec. 7	243	123	204	238	117	226	311		94	127	119	269	257	293	242	98	208	112
Dec. 8	184	44	238	105	23	223	298		101	128	42	238	325	127	122	112	211	129
Dec. 9	148	105	226	89	108	104	249		158	162	63	43	243	175	42	41	197	150
Mean	166	90	218	135	63	201	286	7	124	138	87	214	259	227	115	97	148	159
Departure	+5	−26	+44	+11	−14	+16	+83	−1	−9	+1	+5	+3	+48	−30		−2	+27	+23
Dec. 10	229	207	203	116	118	70	74		134	158	80	52	280	92	40	92	78	135
Dec. 11	241	130	66	220	54	93	100		235	217	45	230	54	289	141	140	60	224
Dec. 12	103	49	66	124	42	90	213		207	154	133	89	75	241	89	163	41	193
Dec. 13	16	172	235	15	44	212	195		63	54	22	248	73	287	19	20	117	57
Dec. 14	105	185	85	112	145	48	243		150	111	80	232	190	190	69	120	37	100
Dec. 15	237	53	77	181	32	226	287		185	191	41	246	280	291	85	71	64	193
Dec. 16	217	105	168	134	54	112	287		129	111	107	214	261		177	88	118	126
Mean	164	129	129	129	70	122	200		158	142	73	187	173	232	89	99	74	146
Departure	+25	+15	−30	+14	−13	−45	+79	−5	+5	+18	−14	+3	−9	−9		−23	−33	+13
Dec. 17	175	69	164	174	58	256	241		188	136	44	277	271	276	89	72	98	183
Dec. 18	119	192	183	81	169	245	292		156	130	13	279	285	283	119	119	51	133
Dec. 19	153	187	163	166	161	247	305		197	160	22	269	244	289	145	156	132	194
Dec. 20	199	95	176	83	164	152	271		141	74	114	243	305	194	60	64	83	92
Dec. 21	214	96	41	223	126	245	242		235	226	21	275	155	287	224	169	111	228
Dec. 22	177	26	10	117	36	118			215	192	28	264	44	283	155	144	84	201
Dec. 23	26	27	122	41	74	163			75	75	71	172	218	178	7	38	39	87
Mean	152	99	123	126	112	204	270	2	172	143	45	254	218	256	114	109	85	160
Departure	+7	−19	−49	+18	+22	+51	+87	−4	+42	+28	−19	+28	+6	+6		+25	−17	+32
Dec. 24	186	46	26	86	19	254	178		19	24	82	268	251	299	62	86	150	20
Dec. 25	214	34	3	181	4	74	232		216	202	144	120	177	156	53	14	122	208
Dec. 26	112	30	95	43	24	256	138		178	151	145	147	239	177	54	62	181	169
Dec. 27	146	89	175	87	8	80	203		138	118	147	62	72	93	34	11	174	120
Dec. 28	83	123	198	54	82	68	242		200	178	102	218	332	281	30	35	187	201
Dec. 29	83	167	56	182	48	190	99		85	70	144	149	342	236	141	115	119	62
Dec. 30	229	60	12	203	53	183	304		119	134	145	145	215	210	208	179	92	110
Dec. 31	118	70	15	45	24	174	211		63	101	162	204	147	230	65	83	113	116
Mean*	146	78	72	110	33	160	201	1	127	122	134	164	224	210	81	73	142	127
Departure	−3	−40	−91	−14	−50	+19	+65	−5	−9	+9	+59	−35	+55	−13		−24	+26	+4
Accumulated departures on Dec. 31, 1941																		
	+6,129	+2,692	−9,387	+13,958	+15,057	−2,788		+1,615	−163	+212	+108	+28	+17,331	−4,836				−366
Percentage departures for the year																		
	+4.9	+2.3	−7.0	+12.1	+14.3	−1.7		−13.9	−0.1	+0.3	+0.1	±0	+13.9	−3.1				−0.2

* 8-day means.

TABLE 2.—*Average daily totals of solar radiation (direct + diffuse) received on a horizontal surface*

[Gram-calories per square centimeter]

LATE DATA—BLUE HILL OBSERVATORY, MILTON, MASS.

Date	Calories	Date	Calories	Date	Calories	Date	Calories
June 4	318	July 6	671	Aug. 6	632	Nov. 2	133
June 5	56	July 7	346	Aug. 7	629	Nov. 3	247
June 6	662	July 8	161	Aug. 8	625	Nov. 4	305
June 7	512	Mean	440	Aug. 9	506	Mean	180
June 8	584	July 9	524	Aug. 10	653	Nov. 5	211
June 9	783	July 10	690	Aug. 11	629	Nov. 6	39
June 10	662	July 11	609	Aug. 12	484	Nov. 7	132
Mean	513	July 12	135	Mean	594	Nov. 8	237
June 11	558	July 13	516	Aug. 13	632	Nov. 9	167
June 12	488	July 14	696	Aug. 14	505	Nov. 10	221
June 13	161	July 15	614	Aug. 15	316	Nov. 11	201
June 14	198	Mean	540	Aug. 16	234	Mean	172
June 15	295	July 16	415	Aug. 17	604	Nov. 12	266
June 16	224	July 17	108	Aug. 18	570	Nov. 13	193
June 17	645	July 18	400	Aug. 19	40	Nov. 14	164
Mean	367	July 19	188	Mean	414	Nov. 15	226
June 18	526	July 20	673	Aug. 20	619	Nov. 16	222
June 19	699	July 21	650	Aug. 21	569	Nov. 17	270
June 20	579	July 22	586	Aug. 22	518	Nov. 18	225
June 21	658	Mean	432	Aug. 23	441	Mean	224
June 22	680	July 23	515	Aug. 24	617	Nov. 19	200
June 23	176	July 24	357	Aug. 25	234	Nov. 20	212
June 24	709	July 25	576	Aug. 26	455	Nov. 21	247
Mean	575	July 26	596	Mean	493	Nov. 22	254
June 25	719	July 27	514	Aug. 27	419	Nov. 23	20
June 26	707	July 28	207	Aug. 28	599	Nov. 24	247
June 27	650	July 29	595	Aug. 29	563	Nov. 25	244
June 28	667	Mean	480	Aug. 30	437	Mean	203
June 29	436	July 30	103	Aug. 31	151	Nov. 26	172
June 30	584	July 31	205	Sept. 1	446	Nov. 27	197
July 1	456	Aug. 1	473	Sept. 2	578	Nov. 28	218
Mean	603	Aug. 2	558	Mean	456	Nov. 29	190
July 2	606	Aug. 3	523	Oct. 29	325	Nov. 30	67
July 3	612	Aug. 4	514	Oct. 30	107	Dec. 1	220
July 4	186	Aug. 5	555	Oct. 31	108	Dec. 2	45
July 5	494	Mean	419	Nov. 1	28	Mean	158

POSITIONS, AREAS, AND COUNTS OF SUN SPOTS FOR DECEMBER 1941

[Communicated by Capt J. F. Hellweg, U. S. Navy (Ret.), Superintendent, U. S. Naval Observatory.] All measurements and spot counts were made at the Naval Observatory from plates taken at the observatories indicated. Difference in longitude is measured from the central meridian, positive toward the west. Latitude is positive toward the north. Areas are corrected for foreshortening and expressed in millionths of Sun's hemisphere. For each day, under longitude, latitude, area of spot or group, and spot count, are included assumed longitude of center of the disk, assumed latitude of center of the disk, total area of spots and groups, and total spot count

Date	Eastern standard time	Mount-Wilson group No.	Heliographic				Area of spot or group	Spot count	Plate quality	Observatory
			Difference in longitude	Longitude	Latitude	Distance from center of disk				
1941	h m		°	°	°	°				
Dec. 1	15 6	7333	−38	251	−5	38	121	1	F	U. S. Naval.
		7332	+19	308	+9	21	170	17		
		7331	+32	321	+9	34	145	3		
		7334	+43	332	−14	45	12	1		
		7329	+45	334	−20	48	242	13		
		7329	+51	340	−19	53	218	1		
				(289)	(0)		908	36		
Dec. 2	11 25	7333	−25	252	−5	26	121	1	F	Do.
		7335	+3	280	+5	7	12	2		
		7332	+30	307	+9	31	121	6		
		7331	+42	319	+10	43	97	8		
		7329	+57	334	−19	59	145	9		
		7329	+61	338	−19	63	218	1		
				(277)	(0)		714	27		
Dec. 3	10 35	7336	−65	200	−9	66	73	1	G	Do.
		7333	−12	253	−5	13	121	2		
		7335	+15	280	+5	17	12	2		
		7332	+42	307	+9	43	73	4		
		7331	+56	321	+10	57	97	3		
		7329	+75	340	−19	75	218	1		
				(265)	(0)		594	13		
Dec. 4	10 54	7338	−80	171	+6	80	48	1	F	Do.
		7336	−59	192	−7	59	24	1		
		7336	−51	200	−10	52	24	1		
		7333	+2	253	−5	5	97	1		
		7335	+29	280	+3	30	24	4		
		7337	+30	281	−10	32	97	5		
		7332	+56	307	+9	57	24	2		
		7331	+70	321	+10	70	48	1		
				(251)	(0)		386	16		

POSITIONS, AREAS, AND COUNTS OF SUN SPOTS FOR DECEMBER 1941—Continued

Date	Eastern standard time	Mount-Wilson group No.	Heliographic				Area of spot or group	Spot count	Plate quality	Observatory
			Difference in longitude	Longitude	Latitude	Distance from center of disk				
1941	h m		°	°	°	°				
Dec. 5	12 21	7338	−69	168	+7	69	97	7	F	U. S. Naval.
		7336	−44	193	−7	45	48	1		
		7333	+16	253	−5	17	97	1		
		7335	+43	280	+4	44	24	2		
		7337	+45	282	−10	46	97	9		
		7332	+70	307	+10	70	12	1		
				(237)	(0)		375	21		
Dec. 6	10 19	7338	−55	170	+7	56	121	8	F	Do.
		7336	−31	194	−7	32	24	2		
		7339	−30	195	−10	32	12	3		
		7333	+29	254	−5	30	73	1		
		7337	+58	283	−9	59	291	14		
				(225)	(0)		521	28		
Dec. 7	11 37	7340	−85	126	−6	85	24	1	F	Do.
		7338	−41	170	+8	43	48	3		
		7336	−19	192	−7	21	12	2		
		7333	+41	252	−6	42	97	2		
		7335	+68	279	+5	68	24	1		
		7337	+71	282	−9	71	194	7		
				(211)	(0)		399	16		
Dec. 8	11 1	7340	−73	126	−8	73	291	9	F	Do.
		7338	−28	171	+8	30	12	3		
		7338	−27	172	+8	29	36	3		
		7333	+55	254	−6	55	73	4		
		7337	+85	284	−8	85	97	2		
				(199)	(0)		509	21		
Dec. 9	12 10	7340	−60	125	−8	60	291	18	G	Do.
		(*)	−36	149	+12	38	24	4		
		7338	−16	169	+7	18	24	2		
		7333	+69	254	−6	69	97	1		
				(185)	(0)		436	25		
Dec. 10	10 41	7340	−47	125	−8	48	242	14	G	Do.
		7343	−22	150	+11	26	73	7		
		7338	−3	169	+7	8	24	3		
				(172)	(0)		339	24		
Dec. 11	10 53	7340	−33	126	−8	34	291	7	F	Do.
		7343	−9	150	+11	15	97	8		
		(*)	+9	168	+9	12	97	7		
		7338	+11	170	+7	13	48	5		
				(159)	(0)		533	27		
Dec. 12	13 51	7340	−16	128	−7	17	388	16	F	Do.
		7343	+6	150	+12	14	121	14		
		7341	+22	166	+10	25	145	11		
		7338	+26	170	+7	27	97	7		
				(144)	(−1)		751	48		
Dec. 15	11 0	7340	+24	130	−7	25	242	9	F	Do.
		7343	+47	153	+11	48	48	1		
		7341	+61	167	+8	62	48	1		
		7341	+65	171	+6	66	48	1		
		7338	+71	177	+9	72	97	8		
				(106)	(−1)		483	20		
Dec. 16	11 21	7340	+38	131	−7	39	267	7	G	Do.
		7345	+38	131	−12	40	36	4		
		7344	+58	151	−6	58	24	2		
		7343	+61	154	+11	62	12	1		
		7341	+75	168	+8	76	24	3		
		7338	+85	178	+10	85	12	1		
				(93)	(−1)		375	18		
Dec. 17	11 8	7340	+52	132	−7	52	170	1	G	Do.
		7344	+71	151	−6	71	97	2		
				(80)	(−1)		267	3		
Dec. 18	11 2	7340	+65	132	−7	65	145	1	F	Do.
				(67)	(−1)		145	1		
Dec. 19	11 25	7346	−23	30	−9	24	12	2	G	Mt. Wilson.
		7340	+78	131	−5	78	97	2		
		7340	+78	131	−7	78	145	1		
				(53)	(−1)		254	5		
Dec. 20[1]	10 29								G	Do.
Dec. 21[1]	14 7								G	Do.

POSITIONS, AREAS, AND COUNTS OF SUN SPOTS FOR DECEMBER 1941—Continued

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1941	h m		°	°	°	°				
Dec. 22	11 1	7347	−80	294	−8	80	291	1	F	U. S. Naval.
				(14)	(−2)		291	1		
Dec. 24	10 57	7347	−53	295	−8	53	194	1	G	Do.
				(348)	(−2)		194	1		
Dec. 25	14 3	7347	−38	295	−8	39	194	1	G	Do.
				(333)	(−2)		194	1		
Dec. 26	11 29	7347	−26	295	−8	27	194	1	F	Do.
				(321)	(−2)		194	1		
Dec. 27	12 48	7347	−12	295	−8	13	194	3	F	Do.
		(*)	+12	319	+19	23	97	15		
				(307)	(−2)		291	18		
Dec. 29	13 59	7347	+17	297	−8	18	121	3	G	Do.
		(*)	+33	313	+12	36	121	7		
		(*)	+40	320	+19	45	242	12		
				(280)	(−3)		484	22		
Dec. 30	11 26	7347	+29	298	−8	30	97	4	VG	Do.
		(*)	+46	315	+12	48	97	10		
		(*)	+52	321	+19	56	291	15		
				(269)	(−3)		485	29		
Dec. 31	10 57	(*)	−80	176	+8	80	145	1	G	Do.
		7347	+42	298	−8	42	97	4		
		(*)	+58	314	+12	60	73	4		
		(*)	+65	321	+19	68	267	8		
				(256)	(−3)		582	17		

Mean daily area for 27 days = 396.

[1] No spots.
(*) Not numbered.
VG = very good; G = good; F = fair; P = poor.

PROVISIONAL RELATIVE SUNSPOT NUMBERS FOR DECEMBER 1941

[Based on observations at Zurich or Locarno as indicated. Data furnished through the courtesy of Prof. W. Brunner, Eidgenössiches Sternwarte, Zurich, Switzerland]

December 1941	Relative numbers	December 1941	Relative numbers	December 1941	Relative numbers
1	*72	11	*a* 47	21	0
2	*52	12	*a* 47	22	**d* 16
3	*48	13	*a* 46	23	*10
4	**Wacd* 42	14	49	24	8
5	*57	15	49	25	*10
6	*54	16	41	26	15
7	31	17	21	27	**Mc* 32
8	*d* 36	18	8	28	*Mac* 53
9	*Ec* 38	19	7	29	40
10	*Mc* 52	20	0	30	36
				31	*33

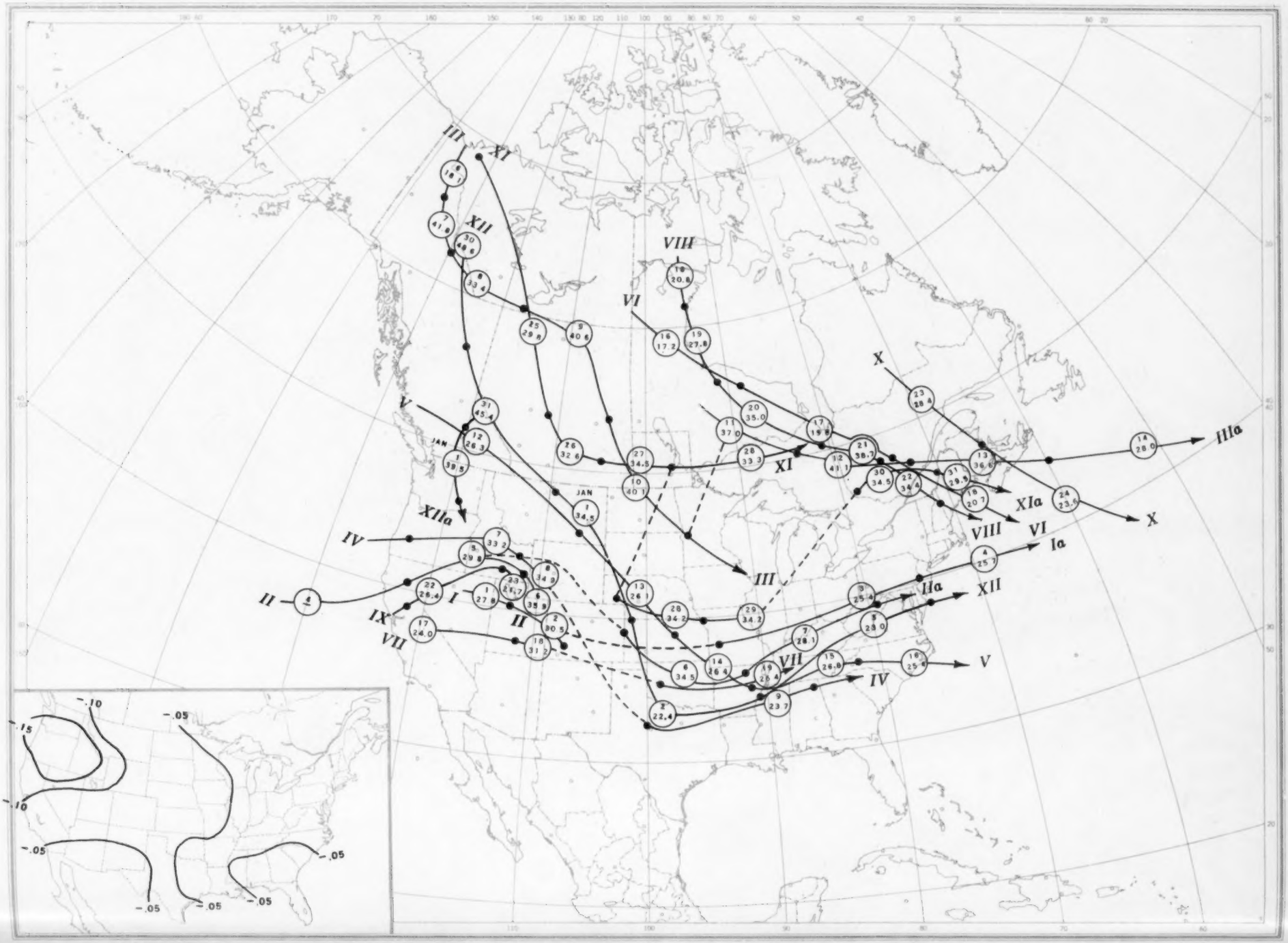
Mean, 31 days = 33.9

*=Observed at Locarno.
c=Passage of an average-sized group through the central meridian.
b=Passage of a large group through the central meridian.
c=New formation of a group developing into a middle-sized or large center of activity; *E*, on the eastern part of the sun's disk; *W*, on the western part; *M*, in the central-circle zone.
d=Entrance of a large or average-sized center of activity on the east limb.

Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, December 1941

Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, December 1941

Chart II. Tracks of Centers of Anticyclones, December 1941. (Inset) **Departure of Monthly Mean Pressure from Normal**

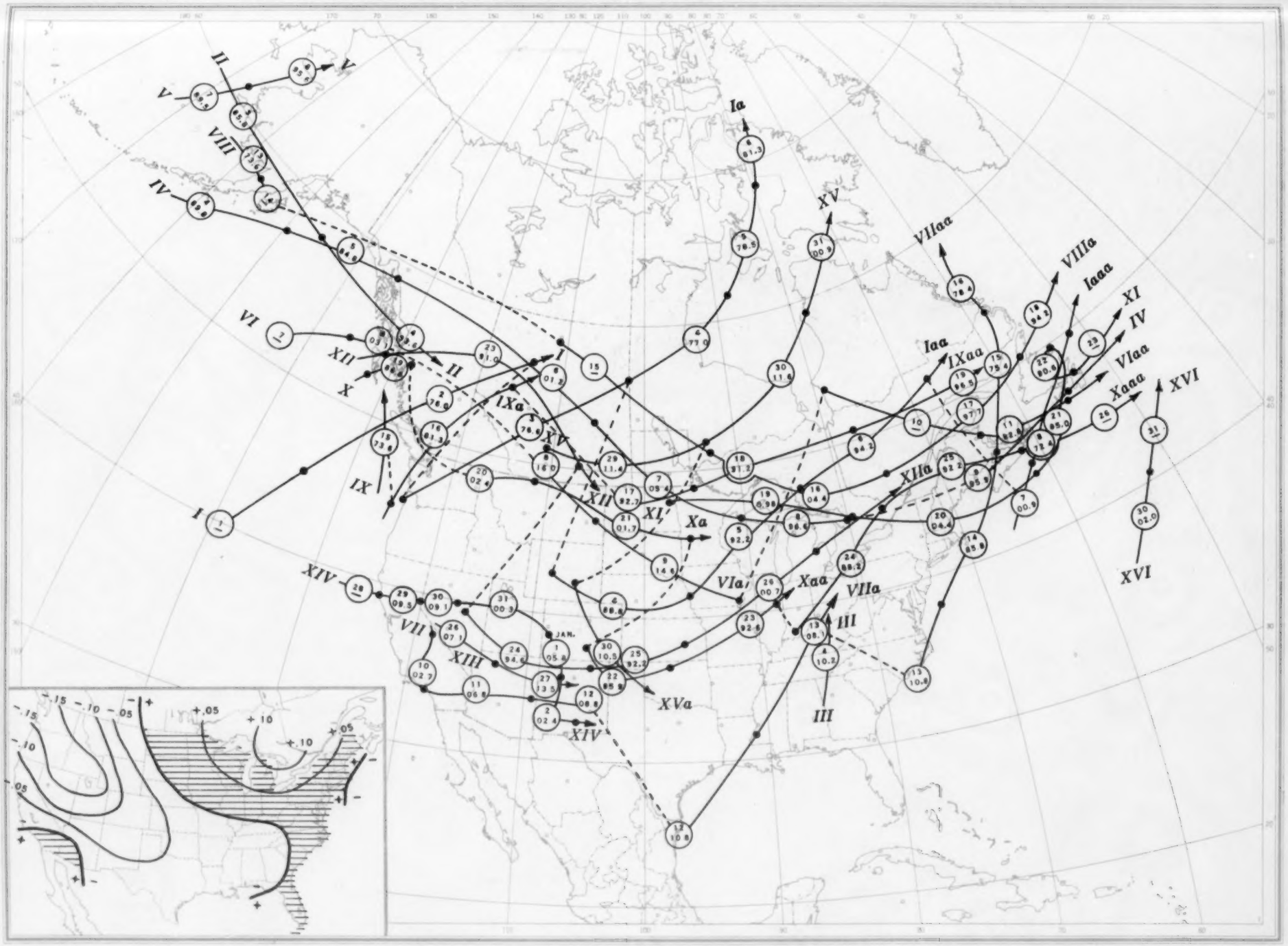


Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7:30 p. m. (75th meridian time).

Chart III. Tracks of Centers of Cyclones, December 1941. (Inset) **Change in Mean Pressure from Preceding Month**

Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7:30 p. m. (75th meridian time).

Chart III. Tracks of Centers of Cyclones, December 1941. (Inset) Change in Mean Pressure from Preceding Month



Circle indicates position of cyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of cyclone at 7:30 p. m. (75th meridian time).

Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, December 1941

Chart V. Total Precipitation, Inches, December 1941

Chart V. Total Precipitation, Inches, December 1941

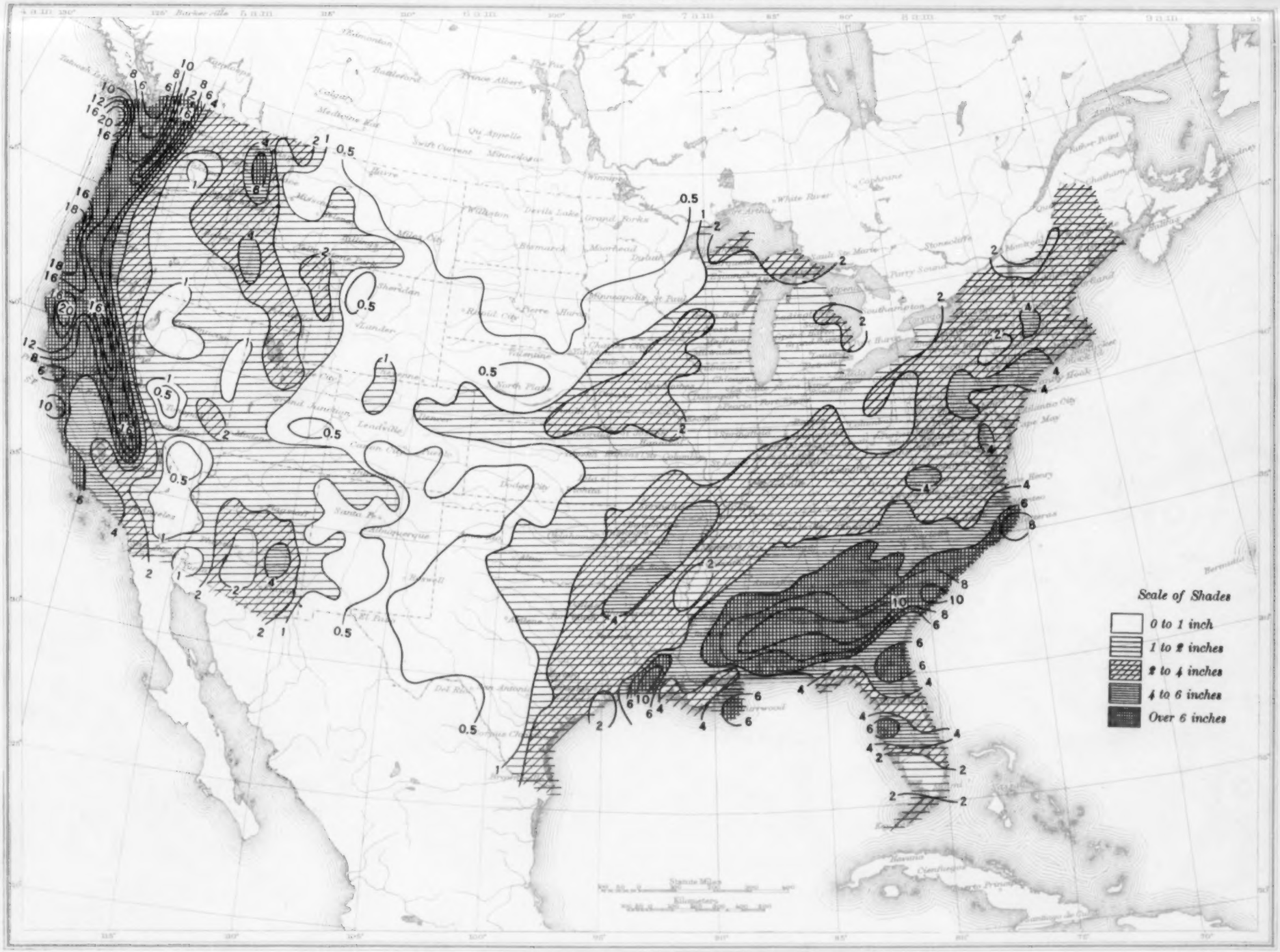


Chart VI. Isobars at Sea Level and Isotherms at Surface; Prevailing Winds, December 1941

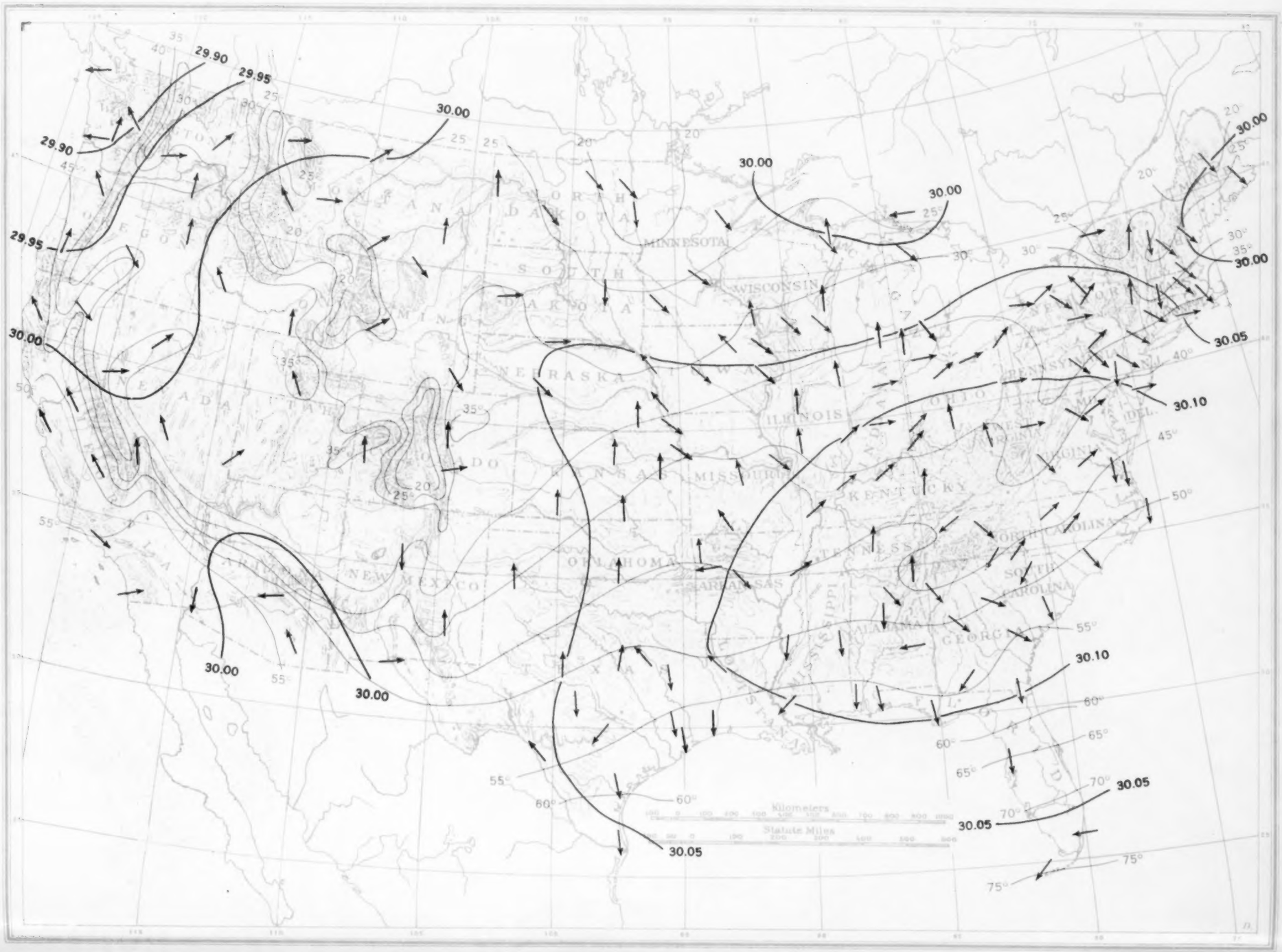


Chart VII. Total Snowfall, Inches, December 1941. (Inset) Depth of Snow on the Ground at 7:30 p.m., Monday, December 24, 1941

Chart VII. Total Snowfall, Inches, December 1941. (Inset) Depth of Snow on the Ground at 7:30 p.m., Monday, December 24, 1941

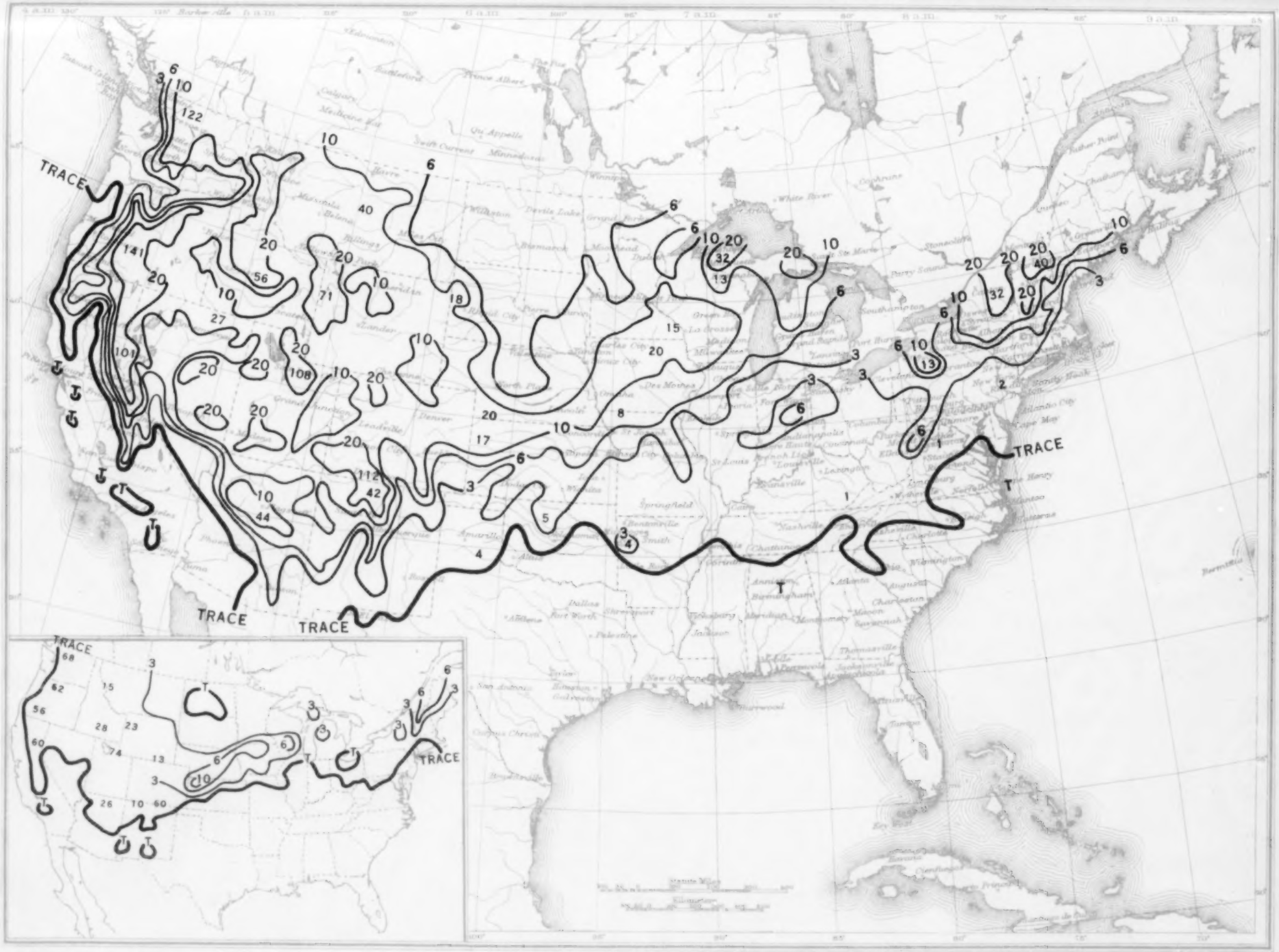


Chart VIII. **Isobars (mb) for 1,524 Meters (5,000 ft.) and Isotherms (°C.) and Resultant Winds for 1,500 Meters (m. s. l.) December 1941**
Isobars and isotherms based on radiosonde observations at 12:30 a. m. (E. S. T.) and winds based on pilot-balloon observations at 5:00 a. m. (E. S. T.).

Chart VIII. Isobars (mb) for 1,524 Meters (5,000 ft.) and Isotherms (°C.) and Resultant Winds for 1,500 Meters (m. s. l.) December 1941

Isobars and isotherms based on radiosonde observations at 12:30 a. m. (E. S. T.) and winds based on pilot-balloon observations at 5:00 a. m. (E. S. T.).

Chart IX. Isobars (mb) Isotherms (°C.) 1:00 a.m. (E.S.T) and Resultant Winds 5:00 a.m. (E.S.T.) for 3,000 Meters (m.s.l.) December 1941

Chart X. Isobars (mb) Isotherms (°C.) 1:00 a.m. (E.S.T.) and Resultant Winds 5:00 p.m. (E.S.T.) for 5,000 Meters (m.s.l.) December 1941

Chart X. Isobars (mb) Isotherms (°C.) 1:00 a.m. (E.S.T.) and Resultant Winds 5:00 p.m. (E.S.T.) for 5,000 Meters (m.s.l.) December 1941

Chart XI. Isobars (mb) Isotherms (°C.) 1:00 a.m. (E.S.T.) and Resultant Winds 5:00 p.m. (E.S.T.) for 10,000 Meters (m.s.l.) December 1941

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